TWENTY BEST PRACTICES FOR CREATING A SUSTAINABLE COUNTRY

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ABSTRACT

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Sustainable development is essential in the modern world. One of the ways to achieve it is to move towards a circular economy. The 20 best practices which are presented in this thesis aim to work as tools that can be used to promote sustainability in every country.

The practices are all different in nature, covering areas such as waste management, transportation, landscape planning, environmental legislation and individual initiatives. Some of them represent the concept of the circular economy in its ideal form, while others are transitional measures, which lead towards a circular economy.

The purpose of the work is to show examples of what can be done nationwide to make a country environmentally, socially and economically sustainable. The methods presented in the research are based on case studies, SWOT analysis, and a communication plan for putting the practices into action.

The thesis includes discussion of general patterns and top issues from the case studies and the SWOT analyses, as well as the factors that are crucial for implementing the best practices. The findings are used to project the implementation of the best practices in Ukraine.

The results indicate that successful introduction of good practices depends on several crucial factors, such as the governmental mechanisms in the country concerned, its economy, the financial wealth and level of education of its citizens, and the effectiveness of the communication plan used for implementing each practice.

Generally, this work has an educative message. It presents different approaches in environmental management and technologies commonly used in developed countries, and this information can be useful for all those interested in understanding the nature of many effective practices for sustainable development.

Key words: sustainable development, circular economy, best practices, Ukraine

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1 INTRODUCTION

1.1 Theoretical background

"If there is anything from where we can absolutely learn - it is nature, because nature is the biggest and the best circular economy. It is millions of years of adaptation and accommodation. It is a system in which everything has a purpose and nothing is lost. We belong to the nature, and that is why we have to behave as we are a part of the nature"
Janez Potočnik[1]

In Europe, three quarters of people's impact on the environment comes from the food and drink sectors, buildings and transport. Transformations in these sectors are needed. The reason for such change is that if the global society continues to use resources at a current rate, then by 2050, considering population growth, it would take the equivalent of two planets to sustain the human needs (European Commission 2015a).

The concept of "best practice"

Best practices are the ones that showed effectiveness in the countries of original implementation, and which can be used as a benchmark for realization in other countries. However, they are not universal solutions to meet sustainability all over the world, because their implementation depends on many factors, such as current political and economical situation in the country, traditions and culture of the society, and local climate.

Sustainable development

Sustainability, to which practices are referred to, represents balance and efficiency in the way people live and industry operates. Term describes how processes run in nature, and is a goal to where people aim - to be eco-friendly to the planet and its inhabitants.

According to the Brundtland Commission's report (also called as "Our Common Future") sustainable development is "a development which meets the needs of current generations without compromising the ability of future generations to meet their own needs" (United Nations 1987, 41). It is not a fixed balance and harmony, but rather a continuous process. The use of resources, the direction of investments, the orientation of technological development, and institutional transformations are made consistently with

[1] Potočnik 2014

present and future needs and aspirations, and enhance the potential of current and future generations (United Nations 1987, 17).

The core of sustainable development needs consideration of "three pillars" together. They are the society, economy and environment. The reason for this is that the realization of only economic growth or any other "pillar" alone leads to unsustainable outcomes. This interconnected nature requires cooperation and coordinated strategies between different governments and neighborhoods. There are no geographical or institutional borders when realizing sustainable development practices (OECD 2008, 2).

Implementing sustainable development needs integration of economic and ecological considerations in decision making (United Nations 1987, 55). Education is an important factor in promoting and achieving sustainable development (Bärlund, 2015). Also, the success of realizing certain practices depends on the level of satisfaction of the society's basic human needs (Maslow 1943, 370-396).

The process of popularizing the concept and principles of sustainable development started when the Brundtland Commission gave proposals at the United Nations Conference on Environment and Development in Rio de Janeiro in 1992. The documents approved at the Conference, particularly the Agenda 21, included commitments by the world leaders to ensure sustainable development around the world on all levels of the society. The concept helped to shape the attitude of international community towards economic, social and environmental development, and boosted national and local actions (Bärlund, 2015).

Problems that were met during implementation of the sustainable development programs, particularly in the countries of Eastern and Central Europe, were the lack concept's understanding in administration, insufficient political support, limited resources at different levels for effective action, inadequate involvement of civil society, inertia in education systems and problems in specific sectors of the economy (Bärlund, 2015).

Circular economy

According to Ellen MacArthur Foundation (2013), circular economy is the economic model, where the flow of resources circulates sustainably, as it is in nature. It means that what used to be waste, in terms of industrial economy, is a product (food), which is

either a biological material that is returned to the biosphere and builds natural capital, or technical material that circulate in industry at high quality without entering the biosphere. Synonyms of the model's term are "cradle to cradle" and closed loop economy.

Circular economy in industrial systems is a closed materials loop that is powered by renewable energy sources rather than by fossil fuels. It is a system with low and falling toxicity, and where natural and social capital is restored. Such economic model simulates living systems and supports the continuous improvements in the quality of life. (Webster 2015, 2).

Moving towards circular economy is at the centre of the Europe's resource efficiency agenda. It is established under the Europe 2020 Strategy for smart and sustainable growth. It is projected that more efficient use of the resources can bring new growth and job opportunities (European Commission 2015b).

2 MATERIALS AND METHODS

The selection criterion for practices is based on finding those ones, which represent the ideals of circular economy. However, there are several transitional practices, which lead towards circular economy. They are chosen, because they are seen as the most effective measures that can be done at the present time. Practices are grouped to waste management, transportation, landscape planning, environmental legislation and individual initiatives.

The selection was also based on answering two questions:

1. Is this the most useful practice from its kind that benefits the society, nature and economy?
2. Being the leader of my country, what actions would I do to make it environmentally friendly?

The selection process is more subjective rather than scientific. It is based on author's personal experiences and observations of living and studying in Finland and travelling around Europe during four years (2011-2015).

SWOT analysis is done for each practice. It is a planning method that is used to analyze strengths and weaknesses (usually internal factors) and opportunities and threats (usually external factors) involved in project's realization. Using SWOT analysis helps to focus on strengths, minimize threats, and take the greatest possible advantage of available opportunities (Mindtools 2015).

In addition, a communication plan is presented for each practice. It shows what type of cooperation occurs between the parties that are involved into realization of the projects.

Practices originate from Finland, Germany, the Netherlands, Ireland, Latvia, Slovenia, Singapore, Canada and the United States.

Discussion about implementation of the best practices in the countries, where they do not operate yet, is done on the example of Ukraine, which is the home country of the writer of this thesis.

3 PRACTICES

The list of 20 best practices:

Waste management

1. Eco-landfill in Latvia
2. Energy recovery (incineration) instead of landfilling
3. Waste sorting and recycling in Germany
4. Zero Waste Strategy
5. Green Dot system in Germany
6. Finnish deep collection containers for waste
7. Recycling of beverage containers in Finland
8. Used equipment as a humanitarian aid from Finland
9. Plastic bag levy in Ireland

Transportation

10. Carbon dioxide-based tax on vehicles
11. Cycling in the Netherlands

Landscape planning

12. Greening of Singapore
13. Singapore's water and wastewater management
14. Eco-Industrial Park
15. Efficient houses
16. Sustainable agriculture

Environmental legislation

17. Legislation is a must
18. Punishment for environmental crimes in Singapore and Canada

Individual initiatives

19. Zero Waste lifestyle
20. Vegetarianism

3.1 Waste management

3.1.1 Eco-landfill in Latvia

Disposing waste to landfills is the least preferable practice of the waste management hierarchy (figure 1). Irresponsibly constructed landfills are prone to producing leachate, which is a toxic liquid that results when rain passes through a landfill and uptakes materials such as heavy metals, pesticides and solvents. Such landfills pollute soils, ground and surface waters, emit toxic gases, and use lands anaesthetically, which can lead to protests by local communities (Bersi – Kathimerini 2013, 1).

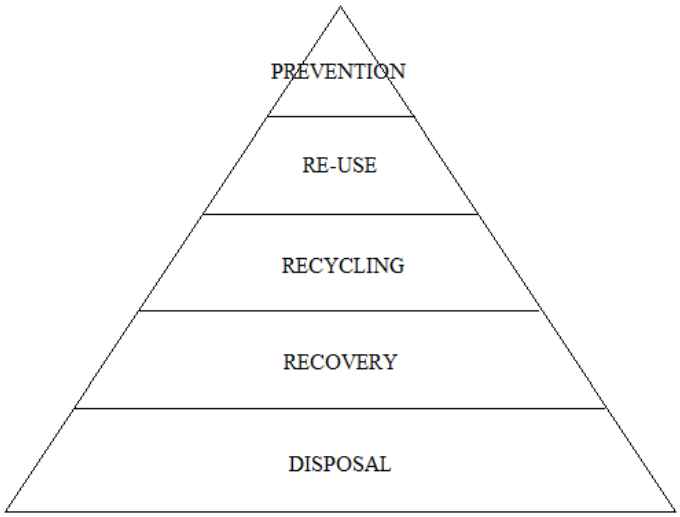


FIGURE 1. Waste management hierarchy: most preferred on the top (redrawn after European Commission 2015c)

Properly constructed and managed landfill can reduce harmful impacts when waste gets into contact with the environment. This practice is transitional, because it does not represent the concept of circular economy. However, it leads towards more sustainable waste management.

Getlini eco-friendly landfill, which is located in the Greater Riga region, Latvia, is the example. Non-recyclables are deposited in environmentally safe sealed cells, which cannot be penetrated by either air or rainwater. Landfill gas, which is formed in the cells, is transferred to the Getlini power unit, where it is incinerated and transformed

into electricity and heat. All wastewater is collected and purified. Such landfill causes minimum harm to the environment (EKO Getlini 2013).

Biodegradable cell at Getlini landfill consists of four main elements:

1. Waterproof foundation, which prevents pollution of ground waters and soil.
2. Infiltrate collection and purification system, where polluted water is collected and biologically purified by the degrading work of microorganisms and active sludge.
3. Gas collection system that prevents pollution of the atmosphere with unpleasant odors and methane. Gas is used for energy production.
4. Cover for the filled cell, which assures that litter does not spread to the surrounding areas, and that possible start of fire and spread of infections transmitted by insects, rodents and birds is eliminated.

Waste disposal site must be chosen so that natural conditions restrict groundwater pollution. However, this was not the case for the original landfill site in the area, which was constructed during 1970s. Respective measures were taken out, and eco-friendly Getlini site began its operation in 1980-1990s (EKO Getlini 2013).

Acording to EKO Getlini (2013), the framework of the project includes:

- The old landfill site with rubbish mound was covered with 0,5 meters of soil and clay, and grass was sowed. The goal of these actions was to reduce infiltrate formation and make collection of methane easier. Toe drain was installed in a semi-circle around the mound and prevents contamination of shallow groundwater.
- New deposit cells are formed and operate in accordance with requirements stated in the European Council Directive on Waste Landfills, Latvian Waste Management Law, Cabinet Regulations and Category-A Permit.
- Waste delivered to the site is controlled in order to prevent mixes containing prohibited hazardous waste.
- Compactor operates within a site everyday to cover it with soil and clay, so that odors, possibility of fire and littering are minimized. Also, movement of the compactor increases the compaction density of the landfill, which allows using the land more efficiently.

- Regular monitoring of surface and groundwater within the landfill's territory and its surrounding area is performed by SIA Getlini ECO since 1999.

The company that runs the landfill (Getlini ECO) provides consultations. It helps to build eco-friendly landfills for those who are interested to implement this practice.

Analysis

SWOT analysis is presented in Table 1.

TABLE 1. SWOT analysis for "eco-landfill"

	Helpful to meeting the objective	Harmful to meeting the objective
Internal factors	**Strengths** - Harmful impact of waste on the environment is reduced, because effluent and methane are collected - Landfill gas utilization - Filled and finished landfill looks aesthetical - Danger of fires, spread of litter and infections is minimized - Cost effective way to dispose waste - Suitable for various waste	**Weaknesses** - Land occupation; limited capacity - Pollution of soil with waste that is degrading - Difficult and costly repairs of the infrastructure, if e.g. leakage in the foundation occurs - Does not represent the concept of circular economy - Specific requirements for site's allocation are needed
External factors	**Opportunities** - Improve state of own environment - Become example for others - Consulting and construction business in the landfill market - Adoption of regulations that require sustainable management of the landfills	**Threats** - Weak or no legislation for landfill's management

Efficient communication plan of taking the practice into action includes cooperation between the government and project's director and managers. Also, waste separation habits of the community play one of the biggest roles in management of eco-landfill, because when separation and recycling rates are high, less waste goes to the landfill.

3.1.2 Energy recovery (incineration) instead of landfilling

The use of landfills reduces in the developed countries. For example, in 1970s Germany had 50,000 landfills. Currently there are about 300 landfills, which only accept what is left after recyclable items are removed from the waste. By 2020, all landfills will be closed, because of German plan to recycle all garbage and produce energy from the residues by incineration (Bersi – Kathimerini 2013, 1). However, ash that is produced during incineration has to be disposed somewhere.

Incineration minimizes the amount of waste in landfills and makes it possible to get energy out of waste. The recovery process and its benefits are presented in Figure 2.

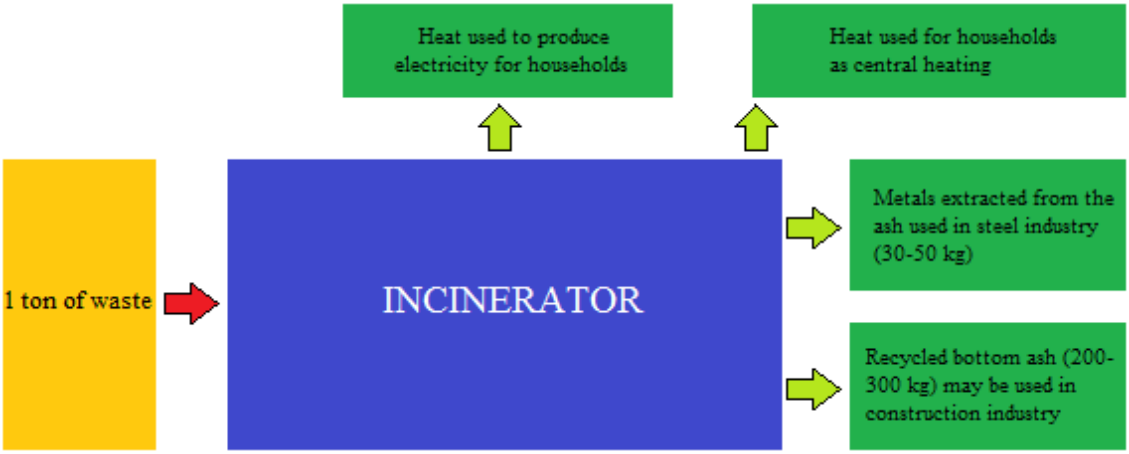


FIGURE 2. Incineration process and its benefits (redrawn after FCC Group 2015)

The trend of using incinerators in the EU is growing with higher speed, comparing to recycling and composting. Between 2012 and 2013 recycling in the EU has grown by 0,6% (from 41,19% to 41,79%), while waste that was supposed to go to landfills reduced by 2%, and was mainly incinerated (Zero Waste Europe 2015).

Incineration issues

Incineration is not that sustainable. When something is burned, production has to start from the beginning of the linear process (extraction-manufacture-consumption-waste), meaning that new raw materials have to be extracted (Connett, 2012).

For four tons of trash, incinerator produces at least one ton of ash, 90% of which is bottom ash (collected under a furnace) and 10% is a toxic fly ash (Connett, 2012).

At the worst case scenario, toxic substances, which are released during burning (dioxins, metals), go into air, and at the best case scenario, they are captured in the fly ash by air pollution control (APC) devices. However, the better the APC is, the more toxic is the ash, which has to be disposed somewhere. For instance in Germany and Switzerland ash is packed into nylon bags and is deposited in salt mines In Japan some incinerators vitrify the ash, producing glass-like material from it, which also consumes big amount of energy (Connett, 2012).

There are no regulations globally for monitoring nano-particles (diameter less than 1 micron), which are produced during incineration. Threat of nano-particles is that they can enter every tissue in the body by penetrating through the lung membrane and entering the bloodstream (Connett, 2012).

Incineration has high social costs. Huge amount of money are spent into machinery (over half of the capital cost is needed for air pollution control) and most of the investment is earned by multinational companies that build the plants. Also, incinerators need few operators. For example, in Brescia, Italy, incinerator cost $ 400,000,000, and created only 80 full-time jobs (Connett, 2012).

Analysis

Taking the advantages and disadvantages of incineration into account, it can be considered as a transitional practice towards circular economy. According to the European Commission (2015d, 4) “member states should support the use of recyclables, such as recovered paper, in line with the waste hierarchy and with the aim of a recycling society, and should not support the landfilling or incineration of such recyclables whenever possible”. Therefore, incineration does not have the priority in the EU legislation.

SWOT analysis is presented in Table 2.

TABLE 2. SWOT analysis for "incineration"

	Helpful to meeting the objective	Harmful to meeting the objective
Internal factors	**Strengths** - Requires minimum land - Provides quick solution to waste - Generates electricity and heat - Operates in any weather - Reduces waste volumes for disposal - By-products (ash and metals) may be utilized	**Weaknesses** - Expensive to build and operate - Ash requires testing and proper disposal - Requires skilled personnel and continuous maintenance - Does not represent the concept of circular economy - No control of nano-particles - High social costs
External factors	**Opportunities** - Incineration market is expanding: improved performance and costs - Legislation encourages incineration instead of landfilling - Growing consumption and waste generation rates - Business opportunity – purchase foreign waste and utilize it	**Threats** - Protests by local communities - Possibly changing legislation that will facilitates recycling and reuse

Communication plan of taking the practice into action is mainly done between the government, constructors and operators of the incineration plants. Community can minimize the amounts of waste that is going to be incinerated by sorting it for further recycling. Communication between the waste management companies and the public can popularize the sorting practice.

3.1.3 Waste sorting and recycling in Germany

Germany is a country with highest levels of recycling in the EU, which is largely due to high levels of waste sorting (table 3). Since the 1st of January 2015, separation of organic waste, paper, metal, plastic and glass is mandatory (Umwelt Bundesamt 2014).

TABLE 3. Statistics on municipal waste management in the Europe in 2012 (adapted from Eurostat 2014)

	Municipal waste generated, kg per person	Total municipal waste treated, kg per person	Municipal waste treated, %		
			Recycled & Composted	Incinerated	Landfilled
EU28	492	480	42	24	34
Belgium	456	458	57	42	1
Bulgaria	460	433	27	0	73
Czech Republic	308	308	24	20	57
Denmark	668	668	45	52	3
Germany	611	610	65	35	0
Estonia	279	220	40	16	44
Ireland	570	570	45	16	39
Greece	503	493	18	0	82
Spain	464	464	27	10	63
France	534	534	39	33	28
Croatia	391	381	16	0	85
Italy	529	523	38	20	41
Cyprus	663	663	21	0	79
Latvia	301	301	16	0	84
Lithuania	469	458	21	1	79
Luxembourg	662	662	47	36	18
Hungary	402	402	26	9	65
Malta	589	559	13	0	87
Netherlands	551	551	50	49	2
Austria	552	528	62	35	3
Poland	314	249	25	1	75
Portugal	453	453	27	20	54
Romania	389	313	1	0	99
Slovenia	362	301	47	2	51
Slovakia	324	313	13	10	77
Finland	506	506	34	34	33
Sweden	462	462	47	52	1
UK	472	465	46	17	37
Iceland	*338*	*338*	*42*	*7*	*50*
Norway	*477*	*467*	*40*	*57*	*2*
Switzerland	*694*	*694*	*50*	*50*	*0*

Waste in Germany is disposed in a following way (Ali's Adventures 2015 & Study in Chemnitz 2015):

- Yellow bin or yellow bag are for all recyclable packaging such as empty tins and spray cans, beverage cartons, plastic packaging and polystyrene. Yellow bags can be obtained at the city hall for free or be bought at the supermarkets.

- Blue bin is for collecting paper and cardboard (magazines, leaflets, books, paper or carton packaging). There are also collecting points where paper and cardboard are exchanged for money based on the weight of what was brought.
- Bottle banks are for collecting used glass. Separation is done for white, green and brown glass. Bottle caps should be removed and disposed to the yellow bin.
- Beverage containers for depositing have a sign on them, and can be exchanged for money via reverse vending machines (RVMs) at the supermarkets.
- Brown bin or organic waste collection bin is for disposal of organic waste. It includes food waste and leftovers, coffee filters, tea bags, as well as garden waste.
- Black or gray bin is for residual waste, which is a type of garbage that neither includes pollutants nor reusable components (e.g. ash, dust bags, cigarette ends, rubber, toiletries, diapers, incandescent light bulbs, etc.).
- Hazardous waste includes fluorescent tubes, car batteries and acids, cans of paint that are not empty, thinners, adhesives, corrosives, disinfectants, insecticides, etc. People receive a notice from the local city council on when and where this type of waste is collected by a special truck.
- Batteries are disposed separately at the local shops in small bins.

If there is other waste to throw away (e.g. furniture, building materials), it can be put outside the house at certain announced times, when various items are collected by second-hand dealers (How to Germany 2015).

When living in private houses, bins have to be rolled out onto the street for collection. Areas have designated days when garbage is collected. Garbage collection details can be obtained from the calendars, which residents get at the local registration office or from the community newsletter (How to Germany 2015).

“Recyclinghof” is another recycling opportunity in the majority of German cities. It is an outlying area to which trash can be delivered with a private car. Area is equipped with containers for the deposit of all types of waste – furniture, batteries, electrical and electronic items, paper, plastic, cans, glass, wood and garden waste. Site’s personnel guide people to the proper bins (How to Germany 2015).

Analysis

SWOT analysis is presented in Table 4.

TABLE 4. SWOT analysis for "waste sorting and recycling"

	Helpful to meeting the objective	Harmful to meeting the objective
Internal factors	**Strengths** - Saves resources and energy - Eliminates waste disposal to landfills and incinerators - Generates revenue by selling recycled raw materials - Represents the concept of circular economy - Key to providing a livable environment for the future generations	**Weaknesses** - High initial costs to start the system – collection and recycling equipment - Public perception regarding usability of recycled products - Needs development of waste sorting culture in the society - Some waste cannot be recycled
External factors	**Opportunities** - Changes in governmental policies towards recycling - Growing interest to environmental protection - Improved sorting and recycling technology - Consulting business	**Threats** - Lacking or weak legislation for development of recycling - Insufficient political support - Community's ignorance to sort waste

Communication plan of taking the practice into action includes cooperation between the government and recycling businesses, as well as work with a community. The culture of waste separation needs to be cultivated in the society, and it is a result of many years of dedicated work of the government, recycling companies and public institutions, such as volunteer organizations, schools, etc.

Lacking understanding of the concept in administration and insufficient political support can be the reasons of failure when introducing the practice (Bärlund, 2015). Communication and search for expertise from the professionals (e.g. German officials consulting Ukrainian government) is the way how recycling practice can be effectively adopted in a new country.

3.1.4 Zero Waste Strategy

Zero Waste strategy is a sustainable waste management solution. Its goal is to achieve a point when all waste is reused. Waste diversion represents this strategy. It is the prevention and reduction of generated waste via source reduction, recycling, reuse and composting. It is a better waste management solution than incineration and landfilling, because it generates a bunch of environmental, financial and social benefits, including energy conservation and it reduces disposal costs (EPA 2012).

The benefits of adopting Zero Waste strategy are: three-four times more energy is saved by recycling the same materials, comparing to burning; and creation of jobs. For example, in Canadian province Nova Scotia, the rejection of building incinerator has created over 3000 jobs in the handling of the discarded resources and in the industries using those secondary materials (Connett, 2012).

Some communities in California, Canada, Italy, New Zealand, Spain and the UK have focused on Zero Waste strategy applying waste diversion and achieved great rapid results. For example, San Francisco (850,000 population) has reached 72% diversion from waste disposal. In Italy over 200 communities have reached over 70% diversion. Novarra (population 100,000) has reached 70% in 18 months. Salerno went from 18% to 82% in one year. Villafranco d'Asti (population 35,000) has reached 85% diversion and small town of Ursibil in Spain has reached 86% (Connett, 2012).

Zero Waste community in Vrhnika

Vrhnika, town in Slovenia with 18,000 inhabitants, adopted Zero Waste strategy in 1994. Their result in separate collection of municipal solid waste (MSW) in 2014 was 76,17%. The national strategy is focused on separation rate of only 42%, and incineration is gaining popularity to solve the issue of landfilling (Van Vliet, 2014).

It all started in 1994 when the capacity of town's landfill was at its limit. Two employees of the public waste management body (KPV) persuaded the town that separate waste collection was a solution, even though there were no national targets for it yet.

The first step was to set up necessary logistics and legislative framework for a new type of waste management. Initial focus was on separate collection of recyclable waste

(glass, paper, cardboard, plastic and metal packaging), residual waste (household waste that was not separated and sent for reprocessing), organic waste, hazardous and bulky waste, and construction and demolition waste (Van Vliet, 2014).
Recyclable municipal waste was collected from "eco-islands" on the streets, where residents could throw recyclable packaging. Residual and organic waste was collected door-to-door (Van Vliet, 2014).

In 2002 KPV launched a campaign called KOKO. Residents were encouraged to bring separately collected recyclable waste directly to the collection center, where it was weighted and people were rewarded with points that resulted in reduction of their monthly waste collection bill. "Pay-as-you-throw" scheme was the first of its kind in Slovenia. It brings around 30 tons of waste in Vrhnika per year without the need for collection services. Another impressive change is that residual waste per capita per year reduced from 201 kg in 2004 to 80 kg in 2013. Nowadays KPV collects residual waste once a month by door-to-door method (Van Vliet, 2014).

KPV offers residents the choice between collecting their organic waste door-to-door in special bins or by providing home composting kits. Public campaigns encouraged separate collection of bio-waste (Van Vliet, 2014).

Bulky waste is collected via two methods. Residents can bring it directly to KPV collection center, or ask for KPV to collect in from their home. Bulky waste is disassembled and most of the materials are sent for recycling. Since year 2000, hazardous waste can be disposed of during twice-yearly collections in designated locations around the municipality (Van Vliet, 2014).

Company's activities are based on awareness-raising campaign, which starts with school children. This work is considered as a starting point for the change in behavior and attitudes of the citizens (Van Vliet, 2014). Activities include:

- Schools were provided with bins and discounted waste collection fees for sorting their waste at source.
- Waste-themed events in schools, such as a waste fashion show; organized tours to the collection center.
- Educational lectures for 5 different age groups, from nursery school age to university students.

- Course on specific training for teachers and provision with special educational materials in the field of environmental issues, including waste. Goal – to harness the pedagogical skills between teachers to reach children and their parents.

After the success at schools, KPV moved to work with businesses. It developed special business contracts for waste management, including consultations on how to achieve savings via separation-at-source.

Businesses gave a positive respond, and some asked KPV to help them manage waste flows and organize on-site separate collection. Therefore, the company not only noted a significant increase in the quantities of recyclables, but also opened an opportunity to earn by improving waste management of other companies. Following this success, KPV went on to work with businesses outside the municipality (Van Vliet, 2014).

The public's perception of waste as something dirty, smelly and not useful was also changed. Trucks for waste collection were painted white with flower motifs, bins were regularly cleaned and attractive entrance to KPV collection center was created. The nearby landfill was rehabilitated (Van Vliet, 2014).

The awareness raising campaign works by traditional methods as well. For example, short promotional messages that encourage citizens to sort waste are printed on the trucks, KPV produces a magazine focusing on waste issues, as well as holds lectures and runs thematic campaigns. Information about waste collection is broadcast via local media and is sent through the post with waste collection bills (Van Vliet, 2014).

The positive atmosphere in a community, which was created by environmental awareness, drives the municipality's results and is having a multiplier effect. Recently, the town began to implement waste prevention measures. In 2014 KPV launched a reuse centre (DEPO) on its collection site, to transform waste into desirable goods and recover items that would otherwise be sent to landfill (Van Vliet, 2014).

By 2021 town's goal is to achieve 300 kg of waste generated per capita per year, or 70 kg of residual waste per capita, and 82% separate collection (Van Vliet, 2014).

Analysis

The SWOT analysis is presented in Table 5.

TABLE 5. SWOT analysis for "Zero Waste strategy implemented in a community"

	Helpful to meeting the objective	Harmful to meeting the objective
Internal factors	**Strengths** - Conserves energy and resources - Reduces waste disposal costs - Creates jobs and resilience in community - People save money - Protects environment and human health - Formation of environmentally responsible society - Endless creativity of managing waste and organizing promotional and educational campaigns - Positive atmosphere in the community	**Weaknesses** - Need for individual initiatives to implement the project - Big and continuous work is required - Difficulties with starting the system and changing people's perceptions and habits
External factors	**Opportunities** - Business relations with local and foreign companies - Consulting business for adopting Zero Waste strategy in other communities - Growing awareness about importance to act environmentally responsible	**Threats** - High interest and power of certain companies to build incineration plants - Opposition by government and certain part of the community - Promotion by industries to consume more products, therefore – generate more waste

Practicing Zero Waste strategy resulted in formation of responsible community and clean environment in Vrhnika. The effects are amazing not only for the environment and economy, but also to the health and wellbeing of the local residents. People are engaged into doing something great together; they are united around waste management practices. Vrhnika shows that sustainability can be achieved in municipalities around the world. It is not an easy choice, and big continuous work is required, but the outcomes are worth it.

Efficient communication plan of taking the practice into action includes dedicated work of the project's initiators, who have to persuade town's officials and community to adopt Zero Waste strategy. When the idea is lightened up, legislative base and infrastructure has to be developed. Residents are engaged into the practice by various initia-

tives, such as “pay-as-you-throw” scheme, promotional campaigns, events and educative programs both for children and adults.

3.1.5 Green Dot system in Germany

The Green Dot program was founded by the Duales System Deutschland AG (DSD) in 1990, which itself was established by the retail and consumer goods industry (Birkenstock, 2013). It happened when the German government adopted a packaging law, which required manufacturers to be responsible for the packaging of their products. The Green Dot’s imprint on packaging (picture 1) identifies that the manufacturer and the retailer have paid a license fee for its collection, sorting and recycling (Baughan and Evale 2004, 1).

PICTURE 1. The Green Dot symbol on the bottle of oil bought in the Lidl supermarket

The license fee is based on the packaging material, the weight of the item, and the recycling expenses. It finances the disposal services, which are provided by the DSD. Such approach makes businesses motivated to develop and produce packaging that is lighter, thinner and easier to recycle, thus it saves raw materials, as well as money and energy.

There are two waste disposal systems in Germany. One is established by the DSD, and another is a public-sector waste disposal service (Birkenstock, 2013). The DSD coordi-

nates its activities with the local authorities who are responsible for disposal of waste that is collected from households and in public places (Baughan and Evale 2004, 1).

After the first year of operation, system reduced generation of about one million tons of garbage (How to Germany 2015). In 1995 DSD founded the Packaging Recovery Organization Europe (PRO EUROPE) to avoid trade barriers in Europe by distributing the Green Dot trademark to national collection and recovery systems of the EU and EEA member states (Baughan and Evale 2004, 2).

Currently, the Green Dot system is used by 26 EU states. Those countries do not have economic linkages to the German DSD, meaning that each state gets all benefits from using own system (Birkenstock, 2013).

Analysis

SWOT analysis is presented in Table 6.

TABLE 6. SWOT analysis for "the Green Dot System"

	Helpful to meeting the objective	Harmful to meeting the objective
Internal factors	**Strengths** - High responsibility of producers - Control of efficiency - Reduced use of raw materials and energy - Improvement of the packaging of imported products - Lower costs of products - Falling costs for waste management services	**Weaknesses** - Some of the products might be out of the system
External factors	**Opportunities** - Continuous improvement of the packaging - Introduction of the system to other countries, thus removal of trade barriers and improvement of their environment - Consulting business when introducing system to a new country - Total privatization of waste management, which can result in higher effectiveness	**Threats** - Protests by local utility companies, who want to participate in waste management (Birkenstock, 2013) - Efficient market might facilitate high consumption behavior of consumers, which is good neither for them (obesity, junk generation) nor for the environment (more energy and resources needed for production and recycling)

Introduction of the Green Dot system does not require educational or informative work among the society, because its success depends on the manufacturers, who improve the packaging of their products. Therefore, communication and cooperation between the officials and producers is what defines the successful adoption of the practice.

3.1.6 Finnish deep collection containers for waste

The main types of household waste disposal in Finland are: Molok deep collection containers and basic containers with wheels or bins (picture 2). Another method is a “tube collection”. Its idea is that the waste is collected via underground tube system, which conveys separated solid waste to the collection center, without the need to use waste collection trucks. This system is new and is currently under construction in Vuores, Tampere (Pirkanmaan Jätehuolto 2015).

PICTURE 2. Containers on wheels (left) and Molok containers (right)

The advantages of Molok containers are that they are more effective than basic containers on wheels. They fit more waste (need less collection times – picture 3), are easy to use, because container’s lid is light and can stay in a fixed position, look esthetical, and have cool environment for waste, keeping away the bacterial growth and smell.

PICTURE 3. Molok container being emptied by Pirkanmaan Jätehuolto

Such containers perfectly suit in places mainly with high waste disposal rates, such as densely inhabited residential areas and public places (parks, beaches, golf fields, etc.). However, containers with wheels or bins better suit to the places, where access of waste trucks is limited, and where the waste disposal rates are low (private cottages).

Analysis

SWOT analysis is presented in Table 7.

TABLE 7. SWOT analysis for use of "deep collection containers for waste"

	Helpful to meeting the objective	Harmful to meeting the objective
Internal factors	**Strengths** - Efficiently used space of the site - Big volumes of waste fit in - Less collection times needed - Aesthetical appearance of the area - Odors and bacterial growth in the containers are minimized - Easy to use - Different sizes and appearances for wide range of needs - Durable and leak-proof	**Weaknesses** - Allocation depends on accessibility for collection trucks - Do not suit to for individual use at private houses - Need for special truck fleet - Need for periodic cleaning and maintenance
External factors	**Opportunities** - Growing governmental and public interest to increase efficiency of waste collection - Improved design and appearance to popularize such containers among the public - Areal planning, so that collection sites are located near residential buildings, and are convenient to use	**Threats** - No entry for trucks, e.g. design of old residential areas in city centers - Development and introduction of new waste collection systems, e.g. tube collection

Effective plan of taking the practice into action requires, firstly - establishment of the recycling centers, and secondly – creation of the special fleet of trucks for separate waste collection. Also, agreement to open a site for deep collection containers in a good location for users has to be made with territory's owner. Communication plan between the waste management companies and the public includes promotion and education to sort the waste accordingly. It can be done via local media and in public institutions, such as schools.

3.1.7 Depositing system for recycling of beverage containers in Finland

PALPA is a Finnish privately owned non-profit company, which administers and develops deposit-based systems for beverage containers in Finland, as well as reminds people of the importance of returning used beverage containers. PALPA facilitates businesses of 7 companies (main breweries and retail trade) that own it (PALPA 2015).

PALPA is not supported by the Finnish government. According to Olli Alanen (2015) incomes come mainly from recycling fees, material sales revenue and deposit surplus of non-returned packages. Company covers its own costs and adjusts the recycling fees accordingly.

The returning rate of all containers in Finland is around 90%, which is a top class globally. There is a developed network of about 4000 reverse vending machines (RVMs) in Finland that accept empty containers (PALPA 2015).

Joining recycling system for producers is voluntary. However, according to the Waste Law, there is a tax for beverage packages of 0,51 € per liter. By joining PALPA's system or establishing own recycling system, tax can be avoided (Vihavainen, 2015).

Almost all soft drink, water, beer, cider, long drink and sport drink bottles and cans can be deposited. RVMs accept empty beverage containers and return money to the users by reading container's barcode. Every depositing place usually has a container for disposal of bags, a sink and a dryer for cleaning hands after depositing the bottles (picture 4).

PICTURE 4. Reverse vending machine in the "Sale" shop in Tampere

Finnish tariffs for returned containers are following: all glass bottles are worth 10 cent, cans are worth 15 cent, and plastic bottles are worth 10 cent (max 0,35 l), 20 cent (over 0,35 l and under 1 l), and 40 cent (1 l and over) (picture 5).

PICTURE 5. Deposit markings are present on each type of the container

Depositing is attractive to people, because there is a financial interest, and also, because containers will be recycled. People feel good as they act environmentally responsible and for getting financial reward. This system supports tidiness on the streets – bottles, which were left as trash, are collected by people who earn money by depositing them.

The container's cycle goes in a following way: prior to the release of a new beverage container into the market, it is registered into PALPA's recycling system by the importer or brewery. Lifetime membership vary between 3500 € to 6500 €, depending on the material of a container. After the product was introduced to the market, consumer gets back the deposit fee by returning the registered beverage container to the RVM (PALPA 2015).

The deposit payer (producer, importer) delivers sold item numbers to PALPA every month. PALPA charges a deposit fee and a recycling fee from the deposit payer depending on the amount of the sold items. Then PALPA pays back the deposits to the shopkeepers that have paid them to the consumers (PALPA 2015).

The system is in balance, no one loses money. When customer buys a drink, part of its total price is the price of a container. That container's part goes to PALPA. For example when 1000 plastic 0,5 l bottles are sold, 200€ goes to PALPA. When customer deposits those bottles, shopkeeper pays the deposit. Then PALPA pays back money to the shopkeeper. Possible scenario: no one bought a drink at the shop, but everyone deposited the bottles. System still works in such case, because shopkeeper does not pay from the own pocket. Deposit money will be always returned to the shop. In case of the opposite scenario, when everyone bought drink and a certain shop and no one deposited bottles at that shop, result is same. Part of each bottle's price is sent to PALPA as a deposit; and that money will be paid to any shop which received bottles and paid deposit fee to customers from its pocket.

Collection of empty packages from the shops is operated as backhaul transportation by those who deliver full beverage containers to the stores. For baling, counting and bin handling processes PALPA has own contracts with handling centers operated by the third party. Currently Paperinkeräys Oy and Lassila & Tikanoja are providing that service. PALPA also has contracts with material recycling companies. The material has sales value because of good quality and recyclability (Alanen, 2015).

According to PALPA (2015), recycling is done in a following way:

1. Beverage cans are transported to the baling stations. Bales are then supplied as a raw material to recycler, where aluminum is melted and casted into bars, being ready for the next use, for example, as a new beverage can.
2. Plastic bottles are sent to recycling station for baling. Then bales are crushed. Crushed grain is washed and granulated, and then reused as a raw material.
3. Recyclable glass bottles are not re-used as they are, but the raw material is recycled and is utilized for various purposes, such as construction and glass production.

Shopkeeper decides whether to install reverse vending machines or not. However, Waste Law determines that if shop sells products like cans or bottles, it is obligated to receive empty ones from the consumers. RVM is not mandatory, but shopkeeper's obligation to receive returns remains. If volumes are high, using RVM returns are easier and faster for consumer, and shopkeeper does not use human resources on counting returns. So, installation of RVM is a customer service issue too (Vihavainen, 2015).

As a conclusion, PALPA provides sustainable solution for 1,7 billion empty beverage containers yearly, as well as allows for industry to avoid tax (Vihavainen, 2015).

Analysis

SWOT analysis is present in Table 8.

TABLE 8. SWOT analysis for "depositing system for recycling of beverage containers"

	Helpful to meeting the objective	Harmful to meeting the objective
Internal factors	**Strengths** - Sustainable approach - High return rates - Financial and environmental interest for the users - Convenient for the consumer - RVM does immediate separation - Fully automated system, no need for human labor - Gives opportunity for people to earn by collecting bottles in public places - Supports tidiness on the streets - Joining the system is profitable for businesses, because tax is avoided	**Weaknesses** - Some people neglect the importance to return beverage containers and litter - System can be fooled by attaching proper bar-code to a foreign bottle - Bottles with damaged bar-code or surface are rejected by the RVM - System works only for beverage containers sold in Finland - Not all bottles in Finland can be deposited in all shops (e.g. Lidl bottles only in Lidl shops) - Sometimes RVMs do not work, because of maintenance
External factors	**Opportunities** - 100% depositing rates by educating the society - Consulting business for adopting the system in other countries - Develop initiative to deposit foreign bottles	**Threats** - Changes in legislation (e.g. lowering of the tax) - Breakage of RVMs

There are many advantages of establishing deposit-based system for beverage containers. However, the system has several weak sides, which are mainly of a technical nature. For example, from time to time RVMs are out of use, because of maintenance and emp-

tying of the container's storage. Also, if the bar-code from the Finnish bottle is cut off and is placed to a foreign bottle, RVM will accept it (individually proved). It can be assumed that some people can print needed bar-codes and place them to foreign bottles, and earn money this way, resulting in the mess of PAPLA's finances and recycling process.

The effective plan of taking the practice into action includes provision of needed infrastructure, financial interest for businesses and society, and educative work with people. Even in Finland empty bottles can be still found in the nature, e.g. in the forests. This happens because people are indifferent to take their waste back. Therefore, promotional work, possibly via TV, internet banners, and other media can be done to enhance environmental responsibility between the citizens. Educative work of caring about nature has to be done for children by their parents and at schools.

3.1.8 Used equipment as a humanitarian aid from Finland

Finland has advanced system of social welfare. Public institutions, such as hospitals, health centers, dental clinics, homes for elderly people, schools and other municipality stocks, regularly renew their infrastructure and equipment.

Usually that equipment and furniture are in good conditions and are totally working. From time to time there are broken things, which can be easily repaired.

The easiest solution would be incineration or recycling. However, this is not the case in Finland.

Equipment is collected, inspected, repaired and sent to other countries as a humanitarian aid. Association that does this work is "Hyöty Työ", which is located in Toijala, Akaa. Its collection range is 200 km radius from Toijala. Aid includes hospital beds and tables, mattresses, medical devices (ultrasound, dental, etc.), wheelchairs and tools for disabled people, office furniture, cloths and food (cereals, etc.) that were not sold in shops, and many others (Hyöty Työ 2015).

Financing of the program is done by the Centre for Economic Development, Transport and the Environment of Pirkanmaa (ELY Centre). Every year 65,000-70,000 € are paid to "Hyöty Työ", covering wages of the employees, office's and site's costs, and personnel's education. Costs for pick-ups of equipment are covered by the Association itself. Yearly about 20,000 € are needed. This money come from the customers (organizations that give away the equipment) who pay reimbursements of expenses, which is about $15€/m^3$; from the sales of scrap metal, pallets, wheel chairs, care beds and other goods; and from social removals for cities' social offices (Lähteenmäki, 2015). Receiver of the donation pays transportation costs to the receiving country, and covers the costs of operation, which are 1050 € for a fully packed 40ft HC sea container (Hyöty Työ 2015).

Every year Association provides employment for ten persons in a form of rehabilitative work. Particularly, these are the people who used to be alcoholics. Work helps them to begin a new life and an employment career. They do not get salary, however food and financial support from the Finnish government is provided. In wage subsidy there are five-six persons in a year. These are the manager, director of work activities, chairman of the board, secretary, cook and general worker (Hyöty Työ 2015).

Usually, equipment is sent to particular developing countries, because of well established connections. However, new receivers appear every year, and if there are too many, they are put in a queue. Selection of goods is done based on the individual needs of the receiver. Foreigners in Finland (who want to help people in their home country) are usually those ones who find Hyöty Työ, make the agreements, cover the costs and facilitate packing and transportation.

Therefore, the purposes of the project are to do humanitarian aid work, promote employment of people, and to make use of equipment and goods, which would otherwise become waste.

Analysis

SWOT analysis is present in Table 9.

TABLE 9. SWOT analysis for "Used equipment as a humanitarian aid"

	Helpful to meeting the objective	Harmful to meeting the objective
Internal factors	**Strengths** - Reuse of equipment saves resources - Helps people in other countries - Provides local employment - Provides rehabilitation work for people with such needs - Builds friendship between Finland and other countries	**Weaknesses** - Difficult to collect equipment in one site from the whole country - Some people cannot afford own investments (transportation and operational costs) - Bureaucratic issues to arrange the documents in the receiving countries
External factors	**Opportunities** - Participation of other regions in the program: higher collection rates and help for more people - Increase financial support by the governmental or private institutions to broaden the scale of work - Popularization of the practice among foreigners – complete reuse of old Finnish equipment	**Threats** - End of financial support by ELY centre

The plan of taking the practice into action needs the cooperation between the government and the donator, because work done by Hyöty Työ has enormous positive impact to the lives of people in other countries and their impression about Finland, as well as on the state of the Finnish environment and to Finns who work at the Association. Also, good co-work is needed between the donator who provides inspected and workable equipment and efficient packing service, and the receiver who pays money, does documentation and provides transport without delays.

3.1.9 Plastic bag levy in Ireland

Ireland introduced the plastic bag levy in 2002. It does not apply to small bags, which are used to pack fruits, confectionery, fresh meat, etc. All consumers had to pay 15 cent for plastic bag with dimensions larger than 225 mm wide, 345 mm deep, and 450 mm

long (including handles). The levy was increased from 15 cent to 22 cent in July 2007 (Irish Statute Book 2001).

This practice encouraged consumers to bring their own bags when shopping, and it encouraged retailers to switch to paper bags, because of the cheaper price. According to The National Litter Pollution Monitoring System (2013, 27), before the levy was introduced, 5% of all litter in the country was plastic bags. In 2013 this figure was 0,14 %.

Analysis

SWOT analysis is presented in Table 10.

TABLE 10. SWOT analysis for "plastic bag levy"

	Helpful to meeting the objective	Harmful to meeting the objective
Internal factors	**Strengths** - Saves resources - Less littering, cleaner environment - People start to care about nature - Financial savings for customers when using less bags	**Weaknesses** - Challenging to adopt in countries where bags are already expensive - Does not apply to small plastic bags, which are consumed a lot - Some people might not care - Difficult to change the habits
External factors	**Opportunities** - New types of bags, which are safer to the environment - Awareness raising campaigns - Changes in governmental policy on use of plastic bags (price increase, ban) - Increasing number of environmentally responsible people	**Threats** - Opposition and protests by people who are used to cheap plastic bags - Companies that purchase bags are freely distributing them among their customers (e.g. cloths shops)

Plan of taking the practice into action is based on the government's determination to reduce the use of bags. When the levy is adopted, consumption of bags decreases. However, it can be difficult for some people to change their habits, and use, for example, cotton bag regularly. Awareness raising campaigns can facilitate the behavior change. People's perception can be modified by providing information about harmfulness that plastic bags do to the environment. Such campaigns can be done for children at schools, and if they get excited, they will inform their parents; via TV and radio programs; by events and exhibitions near supermarkets promoting use of less bags and selling cotton bags for regular use; and by many other creative options.

3.2 Transportation

3.2.1 Carbon dioxide-based car tax in Finland

Finland has a system were citizens are directed to buy low emission vehicles. This is done by imposing taxes. This practice leads to circular economy and can be considered as transitional. The reason is that it facilitates the use of fossil fuel-powered vehicles.

The first tax is a "vehicle tax", which consists of a base tax (based on CO_2 emissions) and a tax on driving power (imposed to vehicles that are powered by other sources than motor petrol). Vehicle tax must be paid yearly for passenger cars, vans, buses, and trucks that have been entered in the Vehicular and Driven Data register (Trafi 2015).

The second one is "car tax after first registration", which is based on the amount of CO_2 emissions or vehicle's mass. The difference with "vehicle tax" is that the "car tax" is paid only when purchasing new automobiles, and it comes in percents (%) from the total price of the vehicle (varies between 5% and 50 %). When purchasing vans, tax rate based on total mass is deducted from tax rate based on CO_2 emissions (Tulli 2014, 3). After paying car tax, vehicle tax is also paid every year.

In case of new vehicles, the base tax is based on the levels of carbon dioxide emissions, which are reported by the vehicle manufacturer. Yearly costs until the end of the year 2015 vary between 43,07 € for 0 g/km of emissions to 260,65 € for 223 g/km of emissions (Trafi 2015).

Older vehicles (passenger cars taken into use for the first time before year 2001; vans - before January 2008) and those without emission data are taxed on the basis of their total mass (Tulli 2014, 1). It varies between 125,93 € (weight under 1300 kg) and 535,46 € (weight over 3401 kg) (Trafi 2015).

The tax on driving power for passenger vehicles, which are powered by other energy sources than motor petrol is based on power type and total mass of a vehicle. For exam-

ple, diesel powered vehicles are taxed by 5,5 cent/day/100 kg and electricity powered are 1,5 cent/day/100 kg (Trafi 2015).

However, tax on driving power for diesel-powered vans and trucks is lower comparing to passenger cars, due to their high carrying capacity. For vans it is 0,9 cent/day/100kg, and for trucks it is 1-2,2 cent/day for each 100 kg of gross weight (Trafi 2015).

According to Perti Holopainen (2015), taxes on emissions, particularly car tax (adopted in 2008), have been successful in directing people to buy low-emission vehicles. Money, which is collected via taxation, goes to general budget and do not have any specific target of implementation.

Analysis

SWOT analysis is presented in Table 11.

TABLE 11. SWOT analysis for "carbon dioxide-based tax on vehicles"

	Helpful to meeting the objective	Harmful to meeting the objective
Internal factors	**Strengths** - Reduces amount of CO_2 emission emitted by cars - Promotes environmental responsibility among the citizens - Less financial expenditures for drivers: less gasoline is used; cheaper cars; lower tax - Collects money to state's budget	**Weaknesses** - Does not work for all people - Tax difference between low and high emission cars is only about 150€ per year (Trafi 2015) - Electric cars are less promoted than petrol powered cars (Trafi 2015)
External factors	**Opportunities** - Adoption of lower tax for low-emission vehicles - Adoption of higher tax for high emission vehicles - Community work to popularize the use of efficient cars - Improved performance of cars	**Threats** - Negligence of the government - People who are ready to pay as much as needed for their big and inefficient cars

Plan of taking the practice into action includes provision of concrete financial savings that people can have when purchasing low-emission vehicles. Promotional work with a community is also required. People should be well informed about the importance and advantages of having an efficient vehicle. This can be done when person is studying at

the driving school; when purchasing a new vehicle at a car dealer shop; and when buying used vehicle person can check the level of car's CO_2 emissions and calculate the taxes to be paid using convenient online-tool that is provided by Traffic Agency.

3.2.2 Cycling in the Netherlands

Using bicycle for transportation within a city is a healthy, economical and environmentally friendly action to do. One of the most cycling countries in Europe is the Netherlands, where bike is an integral part of everyday life. On average the Dutch people used bicycle for 26% of their trips in 2007 (Ministerie van Verkeer en Waterstaat 2009, 11).

Municipalities are responsible for the provision of parking facilities for cyclists at the shops and schools, as well as for the path network (picture 6). The promotion of bicycle use, enhancing traffic safety and combating bicycle theft are the main components of the cycling policy (Ministerie van Verkeer en Waterstaat 2009, 27).

PICTURE 6. Typical Dutch bike lanes (Left – User: Emvee. CC BY-SA 3.0; Right – User: Johntarantino1. CC BY-SA 3.0)

Continuous investments are done in developing and sustaining cycling infrastructure. Money comes via EU funding, subsidies that are administered by the provinces, or cycling infrastructure is developed as an addition to larger constructional projects. For instance municipal bicycle budget for Amsterdam was 26,95 € per inhabitant per year in 2006-2010. During this period 100 million € were invested (Ministerie van Verkeer en Waterstaat 2009, 27).

Analysis

SWOT analysis is present in Table 12.

TABLE 12. SWOT analysis for “cycling in a city”

	Helpful to meeting the objective	Harmful to meeting the objective
Internal factors	**Strengths** - No emissions to the atmosphere - Improves person’s health, mood and body - Low initial investment, comparing to car purchase - Free way to commute - Effective way to promote the action simply by showing an example	**Weaknesses** - High and continuous investments needed to develop and sustain the infrastructure - Possible traffic accidents - Possible theft of parked bicycles - Challenging to cycle for long distances
External factors	**Opportunities** - Advanced infrastructure (e.g. safety, developed roads - ability to reach all destinations) - Popularization of electric bicycles to commute for long distances - Changes in legislation regarding other means of transport (e.g. high tax on use of cars within a city)	**Threats** - Absence of respect between car drivers and cyclers – fatal incidents - Governmental negligence: bad or no cycling infrastructure

Establishment of a system, where cyclists feel powerful and protected, and are offered a convenient opportunity to commute around the city is a great challenge to accomplish. Once the infrastructure and rules are in place, plan of popularizing the practice among dwellers can be realized. It can include provision of information about usefulness and importance of cycling via TV, newspapers, brochures and other media; cycling organizations can arrange special events, e.g. bike-marathon. Also, promotion can be done by charging money for the use of cars (e.g. in city center).

3.3 Landscape planning

3.3.1 Greening of Singapore

The goal of this and next chapter is to show the original vision and actions of Singapore's government in transforming country's environment, and as a result – economy and community.

Development of Singapore is strongly based on actions of Lee Kuan Yew, who was the prime minister of the country, which became independent in 1965. He is recognized as a founding father of independent Singapore, which transformed from "the third world country to the first world country in a single generation" under his leadership.

Lee Kuan Yew with his team worked a lot to make Singapore clean, efficient, stable and growing city-state for Singaporeans and for international businesses. Greening of the city was considered as an important action in reaching that goal. To achieve the standards of quality of public services as in the "first world countries", it was decided to transform Singapore into a tropical city-garden. One of the reasons for this transformation was that the city's appearance influences the impressions about the city, both for local residents and for visiting officials and investors. (Kuan Yew, 2000).

Special department for protection and planting of trees was created in the Ministry of National Development. Millions of trees, palms and bushes were planted. Greening raised the morality of residents and made them proud of their city. Nowadays there is a requirement for new businesses – prior to the opening, areas of the enterprises have to be greened and trees planted (Kuan Yew, 2000).

Since 1971 the first Sunday of every November is the national day for planting trees ("Tree Planting Day"), which is attended by all members of the Parliament, members of the community centers and their leaders, as well as by the local community. The point for planting in November is that it is the rainiest month in Singapore, meaning that trees require minimum artificial watering.

Government did not have any preferences among districts of Singapore. Areas, which were inhabited by people from various social levels, were treated equally and provided with qualitative infrastructure. Dirty and smelly places and channels were cleaned, mosquitoes and flies were eliminated. All public places within the limits of the city were put in order (Kuan Yew, 2000).

However, society still had bag habits, which were a challenge to fight. People walked on the lawns, spoiled flower beds, stole seedlings, parked bicycles and motorcycles next to the trees, breaking them as a result. Besides, violators were not only the poor ones.

To fight people's indifference towards greening of Singapore, children at schools were taught to take care of plants and look after the gardens. Kids were excited about such activities and shared their experiences with parents (Kuan Yew, 2000).

Another action to make city greener was the planting of grass and creation of the lawns. Expert on gardening from Australia and soil scientist from New Zealand were invited to Singapore to analyze the situation. To grow green and lush grass, compost was recommended to be continuously added as a soil fertilizer. Approach worked on the testing site, and soon all school yards, playgrounds and stadiums were covered with grass. Gradually all the city was covered with greenery.

As the choice of suitable trees, bushes and lianas was limited in Singapore, groups of researches were sent abroad to visit botanical gardens and parks to choose new plants from the countries with similar tropical and subtropical climate. Many plants and trees were brought to Singapore. However, local conditions did not suit for all. 2000 out of 8000 various plants accepted Singaporean conditions. They have successfully multiplied and diversified the local flora (Kuan Yew, 2000).

The program of greening started to bring real dividends, when the leaders of the countries in South-East Asia decided to compete with Singapore in greening of their cities. According to Lee Kuan Yew (2000), no other project was so useful to the region. The neighbors tried to outdo one another in greening of their cities. Competiveness was useful to everyone and reflected well on the morality of the residents, tourism development, environmental protection and played attractive role for the investments.

Analysis

SWOT analysis is present in Table 13.

TABLE 13. SWOT analysis for "city's greening"

	Helpful to meeting the objective	Harmful to meeting the objective
Internal factors	**Strengths** - Develops respect to nature, culture and morality among residents - Trees purify the air and uptake CO_2, which benefits health of the society and environment - Makes city attractive for investments (develops economy) - Increases the value of real estate - Promotes tourism - Promotes greening competition among neighboring countries	**Weaknesses** - Not all trees and greenery can adapt to local conditions - Work with community needs to be done to ensure that no damage is done to local nature - Trees and vegetation needs continuous care - International greening experts might be expensive to hire
External factors	**Opportunities** - State regulations for mandatory greening of cities - Inspire people from other countries - Consulting business for other cities - Number of people who want to live in green cities with clean environment increases globally	**Threats** - Changes in climate - Flora is prone to illnesses - Violations and damages done by some people - Reduction of number of virgin trees during city's expansion

Realization of greening project in Singapore happened due to the dedicated work of the government. Continuous investments were and are done, and professionals did and do the job of greening the city.

Communication and cooperation with society was another key in the project's success. People were informed and educated about the importance of keeping the environment clean and trees undamaged; projects such as "Tree Planting Day" promoted the environmental responsibility among citizens. These measures gradually raised morality of the society and made Singapore an attractive place to live and invest in.

3.3.2 Singapore's water and wastewater management

Singapore had to be kept clean because it would allow collecting and preserving rain water. The goal of the new infrastructural project was to ensure allocation of all wastewater streams from houses and factories into canalization collectors. Drains of clean rain water from the roofs, gardens and open spaces could enter water reservoirs and dammed rivers. Realization of this project took 10 years. By 1981, approximately 240,000 cubic meters of water per day were collected, which was equal to half of Singapore's daily consumption (Kuan Yew, 2000).

Another project was to clean the river Singapore and river basin Kallang, and to return fish to water reservoirs. Effective actions of cleaning every stream and reservoir were taken. Many people, mostly farmers and craftsmen who used to rely on the waters had to move to other places. Majority of pig farms and fish ponds were closed, because of pollution they did to the waters. Nowadays, fish breeding is done in remote and deepwater places from the shore. Government was careful when repositioning people from the rivers and forcing them to change their occupation. Compensations were paid. However, this method did not always work, because many people did not know what to do in the future (Kuan Yew, 2000).

In November 1987 there was an opening ceremony of clean basin of river Kallang and river Singapore, which used to be canalization collectors under the open sky. People who participated in the realization of the projects were honored with golden medals. Soon new eight reservoirs were created and open for boating and fishing. Drinking water collection rose to 500,000 cubic meters per day (Kuan Yew, 2000).

Every project had professional and dedicated leader. Team members were educated and successfully solved unique issues, which were pointed out by the government (Kuan Yew, 2000).

Clean rivers improved the quality of life. Prices on land, particularly on the territories next to the rivers and channels, increased. Sand was bought from Indonesia and spread over the beaches of river Kallang, where people sunbathe and water-ski nowadays. Areas which used to have shipyards accommodate multi-storey buildings. Factories and

workshops were renovated and transformed into cafes, restaurants, shops, hotels, where people have dinners outdoors next to the rivers (Kuan Yew, 2000).

Analysis

SWOT analysis is Present in Table 14.

TABLE 14. SWOT for "city's water and wastewater management"

	Helpful to meeting the objective	Harmful to meeting the objective
Internal factors	**Strengths** - Clean natural water reservoirs: restoration of flora and fauna; clean water supply for the public - Use of rainwater: saves resources and money - Water independence: no need to import water or supply from remote areas - Develops respect to nature, morality and culture among residents - Increases the value of real estate - Makes city attractive for investments (develops economy) - Promotes tourism and recreation	**Weaknesses** - Big financial and labor investments needed to transform the infrastructure - Difficult to teach new norms to all people at the beginning - Continuous control over the quality of waters needed
External factors	**Opportunities** - Adoption of strict legislation for water and wastewater management - Inspire people from other countries - Consulting business for other cities - Rivers and channels for local transportation purposes	**Threats** - Opposition by people who were used to old ways of doing things: unsafe waste discharging, work next to rivers

After the government decides to develop advanced water and wastewater systems, by assigning professionals to do it and does the investments, then work with community has to be done. Plan of taking the practice into action includes educational and supportive work with a community. When the laws and infrastructure are going to be transformed, some people can find it difficult and oppose the change, because they are used to their lifestyle. Sincere communication with citizens and provision of financial compensations by the government are effective methods in adopting the practice.

3.3.3 Eco-Industrial Park

According to Ernest Lowe (2001, 9), an Eco-Industrial Park (EIP) is "a community of manufacturing and service businesses located together on a common property, where members seek enhanced environmental, economic and social performance through collaboration in managing environmental and resource issues. The collective benefit is greater than the sum of individual benefits each company would realize by only optimizing its individual performance".

The concept of EIP represents industrial ecology. Its key theme is moving from linear throughput to closed-loop material and energy use. The fundamental approach of industrial ecology is to utilize industrial by-products and do energy cascading, which is a use of residual energy in liquids or steam, as feedstock for processes other than the ones that created them (Ehrenfeld and Gertler 1997, 2).

Example of EIP is located in Kalundborg, Denmark. The mains linkages are Asnaes Power Station (1,500-megawatt coal-fired power plant); oil refinery operated by Statoil; Novo Nordisk, producer of pharmaceuticals and enzymes; Gyproc, plasterboard manufacturer; and several other users, which use waste streams and energy, and turn by-products into raw materials (Ehrenfeld and Gertler 1997, 3).

Kalundborg symbiosis evolved during 25 years (figure 3). Initial cooperation started to solve a common issue of water scarcity. Water supply system from the Lake Tisso and water exchange system between the companies were developed. Also, as environmental regulations became stricter, businesses were motivated to reduce the costs of compliance and make economic use of their by-products (Ehrenfeld and Gertler, 1997, 3).

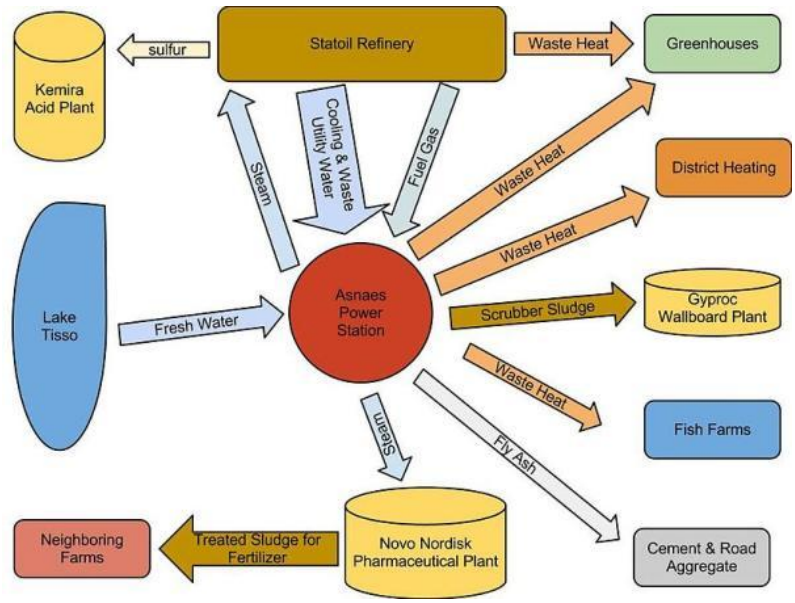


FIGURE 3. Flow chart of material sharing between entities in the Kalundborg EIP (User: Nagilmer. CC BY-SA 3.0)

Asnaes Power Station is the heart of the system. It supplies heat to 3,500 residential furnaces via a network of underground pipes; to own fish farm, where sludge is produced and sold as a fertilizer. Process steam is delivered to Novo Nordisk (meets 100% needs) and Statoil (meets 40% needs). Investment in construction of two-mile long pipelines between Novo Nordisk and Asnaes paid for itself in two years. Thermal pollution of the nearby fjord reduced (Ehrenfeld and Gertler 1997, 4).

The power station provides gypsum-containing feedstock to a neighboring wallboard manufacturer Gyproc. Two-thirds of company's gypsum needs are satisfied. Fly ash and clinker, which remain after coal-burning power generation, are sold by Asnaes for cement production and road construction (Ehrenfeld and Gertler 1997, 4).

Statoil refinery, which produces a range of petroleum products, pipes the gas to Gyproc to fire wallboard drying ovens meeting its all production needs. In 1990 Statoil built a sour-gas desulfurization plant, which produces liquid sulfur that is trucked to Kemira (50km) for sulfuric acid production. When sulfur is removed, Statoil's gas is clean enough to be burned, so it is sent to Asnaes station (Ehrenfeld and Gertler 1997, 4).

Symbiotic linkages of water system have reduced the water demand by around 25%. Freshwater scarcity was the reason of cooperation (Ehrenfeld and Gertler 1997, 5).

Novo Nordisk, which is the producer of insulin, penicillin and enzymes, is located a few miles from Asnaes and Statoil. A nutrient-rich sludge remains after the production. Company distributes it to about thousand nearby farms, where it is spread on the land as a fertilizer. Distribution is free, because the storage facilities are small. It is done via a network of pipelines and tanker trucks (Ehrenfeld and Gertler 1997, 5).

Analysis

SWOT analysis is presented in Table 15.

TABLE 15. SWOT analysis for "Eco-Industrial Park"

	Helpful to meeting the objective	Harmful to meeting the objective
Internal factors	**Strengths** - Use of by-products – saves raw materials (water, coal, gas, sulfur, etc.) - Financial savings for companies - Less thermal pollution of fjords - Less mining for gypsum production - Reliable and efficient supply of by-products to companies who need them (small transportation costs) - Cheap and reliable heat supply for local residents - Symbiosis does not depend on the government (can be done based on private interests)	**Weaknesses** - High initial investments might be needed - Dependency of many businesses on heat supply from the power plant (its breakage can result in their stop)
External factors	**Opportunities** - Show example to other companies - Consulting businesses - Adopting new regulations and popularization of the EIP concept can result in new symbioses - Development of environmental protection legislation and awareness	**Threats** - Breakage in one chain results into inefficiency or stop of the whole system

Communication and cooperation between the managers of various facilities was a key factor that resulted in the establishment of Kalundborg industrial ecosystem. The physical distances between the companies were small and manageable. The needs of one were matching the capabilities of other. There was no original plan for the system as a whole, and each company acted upon own self-interests. The regulatory agencies were

cooperative, but did not require the development of advanced system (Manahan 2007, 538).

3.3.4 Efficient houses

Residential houses and private cottages, office buildings, factories and storehouses form a large energy market. For example in Sweden, energy use in the residential and services sector in 2011 was equivalent to 38% of the total energy use. About 60% of that energy was used for heating and hot water supply (Swedish Energy Agency 2014, 15).

Application of modern technologies during construction of new and restoration of old buildings, can make them energy efficient (passive house) or even energy independent (zero-energy building). It results in reduction of CO_2 emissions, which come from inefficient use of electricity and heat.

Passive houses require little energy for space heating and cooling. They have wooden frames and thick walls, which keep cold air out and generated heat, such as from cooking, lighting, gadget use and people's movements, in. Energy efficiency practices (figure 4) include extra attic insulation, energy-efficient windows, minimized air leakage, adjusted ventilation and ventilation heat exchangers (Gireesh 2012, 5).

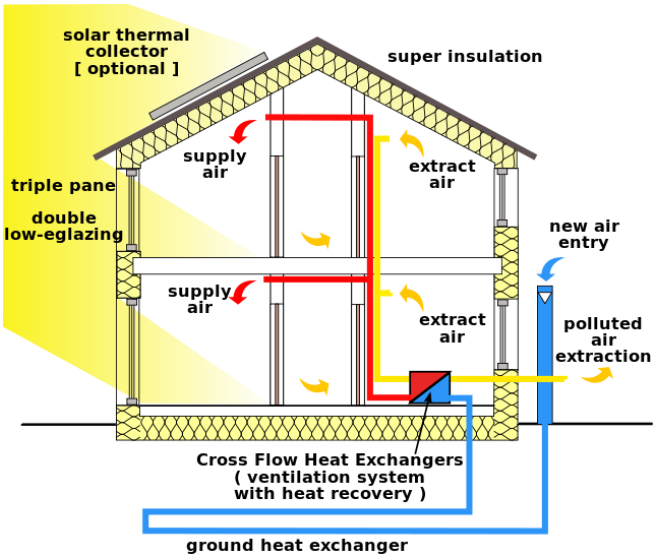


FIGURE 4. Combination of low-energy building techniques are utilized in the Passive house (User: Michka B. CC BY-SA 3.0)

Construction of passive house comparing to conventional building is on average 5-10% more expensive (International Passive House Association 2015). However, efficient house is less costly to sustain, because of a continuous low energy use (figure 5).

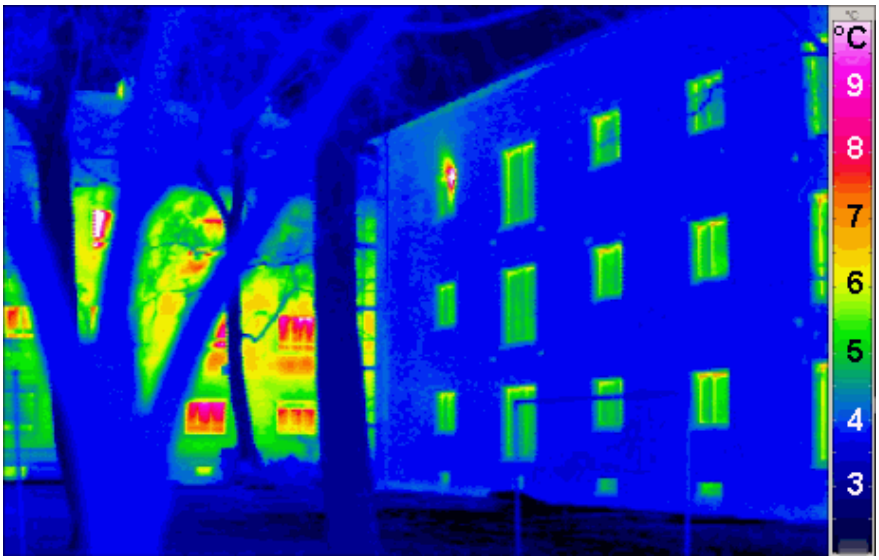


FIGURE 5. Thermogram showing how little heat escapes in a Passive house on the right, comparing to a traditional building on the left (User: Gralo. CC BY-SA 3.0)

Studies conducted in Ireland showed that when a dwelling is built according to the Passive House standards, 85% of energy on space heating can be saved, and as a result 94% less of CO_2 emissions are generated, comparing to when a dwelling is constructed according to the building regulations of 2002 (Kondratenko, 2006).

Another approach for efficient houses is energy-saving ventilated façade. It suits to both new or reconstructed multistory buildings and private houses with heights up to 100 m. The unique feature of this Swedish technology is in the active air channel between the insulation material and the façade stone (figure 6). It works because upward air flow is created due to the temperature difference of warmer air inside the channel and less warmer air outside. This flow minimizes the temperature impacts on the walls of the building and provides ventilation, which takes out the moisture from the insulator and walls. Such approach maximizes energy-saving properties of insulation material and keeps the optimal temperature inside the building in any weather (Scanroc 2011a).

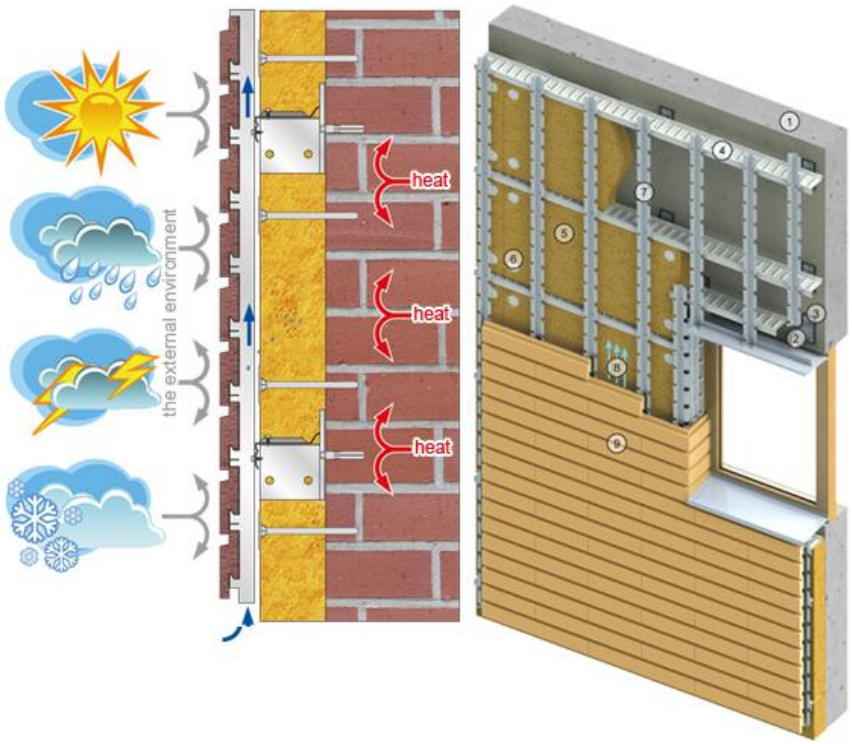


FIGURE 6. Ventilated façade SCANROC with active air channel “8” (Scanroc 2011a and 2011b; used with the permission from SCANROC)

System saves up to 40 % of energy when heating during cold seasons and air conditioning in summer; walls are protected from precipitations, temperature variations, UV lights and mechanical loads, which sustain their durability and prolongs building’s lifetime; various façade designs can be created (picture 7), due to a big variety of colors of granite chips (Scanroc 2011b).

PICTURE 7. SCANROC façade for buildings’ thermal insulation (upper – before the installation, lower - after) (Scanroc 2011b; used with the permission from SCANROC)

The exploitation period of SCANROC stone is estimated to be 100 years in harsh climates. Also, the installation of façade or replacing of damaged stones is easy to do and can be done all year round, because no wet-mix processes are used (Scanroc 2011b).

Analysis

SWOT analysis is presented in Table 16.

TABLE 16. SWOT analysis for "efficient houses"

	Helpful to meeting the objective	Harmful to meeting the objective
Internal factors	**Strengths** - Building's energy consumption and CO_2 emissions are minimized - Financial savings for the residents - Reduced dependency on fossil fuels - Big variety of high-performance technology - Provision of healthy environment inside the building (solar access, no moisture inside walls, etc.) - Develops environmental responsibility among the residents - Improvement of building's appearance - House can be sold easier and more expensive, comparing to traditional one	**Weaknesses** - Usually initial investment is higher, comparing to traditional buildings - Small market with professional constructors - No advanced governmental regulations; construction is often individual
External factors	**Opportunities** - Motivate people to have efficient houses by showing examples - Growing concern and popularity of environmental protection among people - Adoption of regulations to force the construction of efficient houses - Potential for sustainable entrepreneurship	**Threats** - Habits of some people, their satisfaction with current energy use and ignorance about modern technologies - Big amount of old inefficient buildings, which are costly to upgrade - Due to the lack of knowledge and expertise, some projects can fail and result in negative feedback

There are two important factors in creating efficient buildings around the country. The first one is the governmental policy and actions towards the goal of making all building in the country efficient. Construction law, which defines minimum efficiency requirements, and continuous control of house's performance by municipalities, make constructors to build houses accordingly to the norms and even better. The second one is the understanding of the long-term financial and environmental advantages of having an

efficient house. It is important, because initial investments in such house are higher, comparing to traditional one, and can be challenging for some people to accept.

This understanding can be developed by providing information via interpersonal sources, construction companies, installers and energy advisers. Television and advertisements are least effective information sources in homeowners' decision-making (Gireesh 2012, 37). Also, governmental investment subsidies and tax deductions are effective methods in encouraging people to implement energy efficiency measures (Gireesh 2012, 39).

Communication plan including informative policy instruments that aim to influence people's behavior by persuasion, communication and transfer of knowledge promote the implementation of household energy efficiency measures (Gireesh 2012, 7).

This plan is defined in the EU Directive (2006/32/EC), which states that the member states should create a conductive atmosphere for market operators to provide information and advice to the customers on end-use energy efficiency (The European Union 2006).

3.3.5 Sustainable agriculture

Sustainable agriculture is a practice, when the production of food applies farming techniques that sustain the environment, communities and public health, and are profitable.
It is important, because when the production of food degrades the base of natural resources, the ability of future generations to produce and flourish decreases (GRACE 2015a). Implementing such practice is the responsibility of all participants in the system, such as farmers, laborers, policymakers, researches, retailers and consumers (Feenstra, 2015).

Sustainable farms produce crops without the use of toxic chemical pesticides, synthetic fertilizers and genetically modified seeds, and raise animals without the use of non-therapeutic antibiotics and arsenic-based growth promoters. The focus is on sustaining healthy produce, as well as clean soil, water and air (GRACE 2015b).

Biodiversity and ecosystems are protected and developed by growing a variety of plants and using techniques such as multi-cropping, conservation tillage, organic soil fertilization and pasture-raised livestock. Protection of crops from damage by pests (weeds and insects) is done by applying ecological pest control. Application of these practices provides healthy food for the consumers, as well as safety for the workers and surrounding communities (GRACE 2015b).

Animals are treated with respect and care at the sustainable farms. Livestock is raised on pastures, which enables it to move freely, behave instinctively, consume natural food and avoid the stress and illnesses associated with confinement (GRACE 2015a).

Sustainable farms use no or minimal tillage to protect the soil, minimizing its erosion, compaction as well as the loss of water and nutrients, while maximizing aeration. Use of heavy machinery that is powered by petrol is also reduced (Friedrich and Kienzle 2007, 3-4).

Water conservation and sustainable irrigation methods are applied. These include low volume irrigation, rainwater harvesting, planting of drought-resistant crops and crops being bred for a particular environment. Such methods reduce soil's salinization and rapid depletion of aquifers (GRACE 2015b).

Sustainable agriculture can be economically viable, while providing farmers, workers, food processors and other employed in the food system with a livable salary and safe working conditions (GRACE 2015a). Such business benefits to the local communities, because it employs people and distributes money, provides fresh and healthy food, and does not need packaging and transportation, and, therefore, minimizes the use of resources and traffic related greenhouse gas emissions.

Urban agriculture

A growing sustainable crop production practice is urban agriculture. For example, in Japan almost one-third of the national agricultural output is generated by urban agriculture. Local agriculture in/around Tokyo, which is one of the largest cities in the world, produces enough vegetables to feed almost 700,000 residents (Moreno-Peñaranda, 2011).

According to Moreno-Peñaranda (2011), urban agriculture has following roles for the Japanese people:

- It is a source of fresh and healthy products, which are increasingly demanded by the residents.
- It is a source of recreation and well-being.
- Gives opportunity for city dwellers to engage in agricultural activities (allotment gardens, green roofs, etc.).
- Provides education and raises awareness among the residents by developing understanding of agriculture and food issues.
- Increases areas of permeable surface for storm water management and reduces the heat-island effect by cooling the air.
- Diversifies local biodiversity by providing habitats and managing species (e.g. boosting pollination).
- Reduces need for industrialized production, extensive packaging and food miles; therefore, minimizing production and transportation costs and reducing use of resources and generated greenhouse gas emissions.

Study done by the Ministry of Agriculture, Forestry and Fishery (MAFF) indicated that over 85% of Tokyo residents would like the city to have farmland to have a secure access to fresh foods and green space. This is well-illustrated on practice, because the number of allotment gardens in urban areas increased by 67% in the last decade, while in rural areas the amount remained constant (Moreno-Peñaranda, 2011).

Analysis

SWOT analysis for is presented in Table 17.

TABLE 17. SWOT analysis for "sustainable agriculture"

	Helpful to meeting the objective	Harmful to meeting the objective
Internal factors	**Strengths** - Balanced with environment; does not harm or deplete natural resources and wildlife - Diversifies the biodiversity, develops well-functioning ecosystem - Benefits the community by providing fresh and safe food, employing people and distributing money - Provides safe environment for workers and surrounding communities - Is ethically and ecologically correct towards breeding of animals and growing of crops - Urban agriculture can easily target cities' food demand, because of its proximity to consumers - Urban agriculture is educative for people in terms of food production - Improves urban landscape and environment	**Weaknesses** - Food produced by the sustainable agriculture can be more expensive comparing to the industrial one - Amount of time, labor and money invested into sustainable agricultural system can be bigger, comparing to the industrial methods - Challenging to bring eco-friendly products into mainstream
External factors	**Opportunities** - Increasing interest in agriculture and healthy products among the society - Promotion of sustainable agriculture by the international agenda - Technological innovations provide new opportunities for agriculture, particularly for the urban one	**Threats** - Society's behavior and habits that support industrial agriculture - Aging of farmers (e.g. in Japan), hence uncertainty of the future functioning of agricultural areas - Tax barriers and high urban real estate prices and regulations can prevent farmers from producing food in cities

Communication and connection between the farmers who lead sustainable agriculture, and the community who is a market is essential in establishing such environmentally and socially responsible business. Efficient supply-chain of eco-products and provision of information for the community about the benefits of eating such products, make people to choose them, despite the fact that their price can be higher comparing to the industrial products. However, information might not be enough. Society needs to under-

stand the advantages of sustainable agriculture over the industrial. Many people need to change their diet and habits. With the development of consciousness regarding food, demand on sustainably grown and healthy products can increase.

3.4 Environmental legislation

3.4.1 Legislation is a must

The German Green Dot system, Finnish PALPA, plastic bag levy in Ireland and other practices show that legislation is a key factor of establishing sustainable country.

Another example comes from the Netherlands. It is a country, where 50% of the waste is recycled (table 3), the other part is incinerated to produce electricity and heat, and residues are sent to landfills (Feller, 2015).

Dutch waste management approach, called “Lansink’s Ladder”, is following: avoid producing waste, recover the valuable raw materials from it, generate energy by incinerating residual waste, and only then dump what is left. This approach was incorporated into the legislation in 1994 and forms the basis of the waste hierarchy (Feller, 2015).

Regulations implemented by the government proved to be the key factor in creating innovative waste processing market. Recycling targets were put in place for various waste sources, such as organic, hazardous, construction and demolition waste. Tax introduction on every ton of landfilled material was the main factor, which motivated waste processing companies to look for more cost-effective methods, such as recycling and incineration. Similarly as water runs to the lowest point, waste runs to the cheapest (Hoogendoorn, 2015).

Analysis

SWOT analysis is presented in Table 18.

TABLE 18. SWOT analysis for "legislation"

	Helpful to meeting the objective	Harmful to meeting the objective
Internal factors	**Strengths** - Sets equal rules for everyone - Nationwide effect of obeying the laws - Makes businesses and people to look for new practices, which are sustainable and financially more attractive	**Weaknesses** - Some laws and regulations can have hidden paths for their violation - Violations, particularly small ones, can be sometimes unnoticed
External factors	**Opportunities** - Learn from experience of other countries - Continuous improvement of environmental legislation as a global trend - Change in technology as a base for advancing legislation	**Threats** - Corruption in the government and inspection institutions - No leadership - Damaged economy

Plan of adopting legislative practices is strongly based on country's leaders and on the governmental mechanism. When both are not corrupted and work on the benefit of the country, then regulations and laws that facilitate environmental protection can be adopted and their performance controlled. Fast way of informing the society and businesses about changes in the legislation can be done via governmental websites and media.

3.4.2 Punishment for environmental crimes in Singapore and Canada

Financial punishment is one of the methods of education when the rules are violated. According to the Environmental Public Health Act of Singapore environmental crimes among the public in Singapore are littering, open burning of waste, draining offensive substances into watercourses, urinating, defecating and spitting in public places, not disposing of fecal matter of domestic animals in public places and many others of the similar nature (Singapore Statutes Online 2015).

Any person who violates the regulations of the Act is guilty of an offence and is liable on conviction: for a first offence, to a fine not exceeding 1,000 Singaporean dollars

(S$), for a second offence, to a fine not exceeding 2,000 S$, and for a third or subsequent offence, to a fine not exceeding 5,000 S$ (Singapore Statutes Online 2015).

Moral educative method against littering in Singapore is the Corrective Work Order. If a person is caught for throwing rubbish onto the ground, he/she will have to do public cleaning for a certain amount of service hours. The idea of this is to show offenders how hard it is for the cleaners to clean up the public places. People who were caught are also required to wear a bright orange jersey, which identifies them as offenders. The goal behind this is to bring shame and understanding to them that littering is an inappropriate action to do (Poh, 2014).

Penalties for high-scale environmental violations in Singapore are under the Environmental Pollution Control Act and the Environmental Public Health Act. Punishments vary between 20,000 S$ and 1,000,000 S$, plus possible imprisonment (Farmer, 2007).

Another example of environmental protection system is in Canada, where enforcement of country's environmental and wildlife protection laws is a cornerstone of the government's commitment to provision of clean air and water, and the conservation of wildlife species and their habitat (Environment Canada 2014).

Environment Canada's Enforcement Branch principle is to ensure that companies and individuals comply with the pollution prevention and conservation goals, which are stated in acts and regulations. In-field officers conduct the enforcement work across the country. Also, work is carried out in cooperation with all Canadian territorial governments, as well as with international organizations, particularly those from the United States. The work of enforcement officers brings benefits to both environment and wildlife, as well as to communities through court awarded penalties, which are transferred to the Environmental Damages Fund (Environment Canada 2014).

Analysis

SWOT analysis is presented in Table 19.

TABLE 19. SWOT analysis for "punitive system"

	Helpful to meeting the objective	Harmful to meeting the objective
Internal factors	**Strengths** - Effective (also cost-effective) way to re-educate many people and change their bad habits - Strong motivation to act environmentally responsible - Sustains tidiness of the environment - Protects the wildlife and habitats - Makes places attractive for tourists and investors - Collects money to state's treasury	**Weaknesses** - Violators can be not always caught - Habits of some people are difficult to change
External factors	**Opportunities** - By forming responsible, moral and educated society, new accomplishments can be achieved (in science, tourism development, etc.) - Show example to other countries - Society is changing to be more sustainable, because of information provision via internet and media	**Threats** - Corruption of officials and officers - Lack of information provision prior to the violation - Indifferent people who see violation but do not inform officers about it

Communication plan includes information provision from the government to the society and businesses. Environmental regulations and norms have to be well known by everyone. When the practice is new and unpopular, it can be promoted by informing the citizens via TV, radio, newspapers, brochures, emails and other means. Businesses can be informed separately by the officers, because usually their regulations are more advanced and are not worth mentioning in the public (e.g. norms on wastewater discharges). When information was provided, control services can begin their work and punish the offenders.

3.5 Individual initiatives

3.5.1 Zero Waste lifestyle

As described in the chapter "Zero Waste Strategy", the goal of this practice is to have no waste, via its prevention, reuse and recycling. Such practice can be adopted on an individual level, prior to when the government and industries make it happen on a nationwide scale. Moreover, when this approach is accepted and done individually it shows greater outcomes, comparing to when it is taught and promoted in Zero Waste communities.

Lauren Singer lives Zero Waste lifestyle in the New York City. Her journey began in 2013 and since that time she produced only a jar of trash. She runs a blog, where all her story is described. It is called "Trash is for Tossers" (Singer, 2015).

Plastic bags, wrapping, packaging and containers, as well as chemicals are excluded from the use. Focus is on using natural products, which do not pose threat to the person's health and to the environment, because of a need to dispose the waste.

Some of the practices include following: food is bought in bulk in the open markets, where it is wrapped, packed, and delivered home using own jars, towels and cotton bags; food residues are composted; house appliances are all made from wood, metal and ceramics; bulk Castile soap is used instead of conventional dish soap; unwrapped bulk soap goes instead of body wash in packaging; own glass or metal bottle is used instead of plastic bottles or coffee cups; homemade tooth paste and body lotions replace those from the market; white vinegar is used to clean windows, floor and toilet; reusable towels go instead of paper towels; cloths are bought in secondhand shops (Singer, 2015).

By leading thought-out and responsible way of life, Lauren eliminates waste and reduces impact on the environment, because no trash is generated and no chemicals are drained. She is a part of circular economy in a great way, because she takes what is really needed for her life.

Analysis

While the levels of residual waste produced in Zero Waste community of Vrhnika is 80 kg per person per year (Van Vliet, 2014), Lauren's result is around 100 grams for two years (Singer, 2015). Comparing to waste generation per capita per year in Germany, which is around 600 kg of municipal solid waste (Table 3), Lauren's waste generation per year is 12,000 times smaller.

SWOT analysis is presented in Table 20.

TABLE 20. SWOT analysis for "Zero Waste lifestyle"

	Helpful to meeting the objective	Harmful to meeting the objective
Internal factors	**Strengths** - Huge reduction of load on the environment – minimum of energy and resources are used by a person - Benefits person's health and mood, if being sincerely accepted - Saves money - Decreases clutter	**Weaknesses** - People are used to their habits, and it is difficult to change them - Initial discomfort can be experienced when starting Zero Waste lifestyle
External factors	**Opportunities** - Sharing experiences can create new followers, which will benefit them and the environment - New business opportunities of e.g. producing own healthy and eco products, can arise - Meeting new people and making new friends - Becoming a leader of change in society, as a result - popularity and influence	**Threats** - Opposition of businesses - promotions and marketing campaigns in the shops that motivate people to consume more and more - Own disbelief that it is impossible to have a fulfilling life with such a lifestyle

Educational perspective of how people can be introduced and instructed about Zero Waste lifestyle is done via direct sharing of someone's experiences and results. For example, Lauren does it via internet blog, videos for her YouTube channel, presentations at schools, interviews and TV programs.

Even if not accepting Zero Waste lifestyle completely, people can easily behave more responsibly by using cotton bags, buying in bulk, etc., as well as separating waste for recycling. This way, landfilling and incineration is eliminated and raw materials continue their cycle to become products again.

3.5.2 Vegetarianism

The importance and usefulness of vegetarianism for both natural environment and human health are presented.

Environment

This chapter is based on works of Richard Oppenlander, Will Tuttle, Worldwatch Institute, FAO (Food and Agriculture Organization of the United Nations) and on the research done by Kip Andersen, which is presented in the documentary called "Cowspiracy" produced by Kip Andersen and Keegan Kuhn (Cowspiracy 2014).

People are often told to act environmentally responsible. The main measures, which are promoted by the governmental and environmental organizations, include to take short showers, ride bicycle, use efficient light bulbs, separate waste, turn off water when brushing teeth, etc. However, not much is said about the vegetarian diet and the impacts of animal-based food industry onto the environment of the Earth.

According to the United Nations, rearing cattle produces more greenhouse gases than the whole transportation sector, 18 % to 13 % correspondingly (FAO 2006). The reason is that cows produce substantial amount of methane during their digestive process, which has 25 times greater impact on climate change than carbon dioxide (EPA 2015). However, studies and analysis of human-induced greenhouse gases, published by the Worldwatch Institute in 2009, stated that animal agriculture is responsible for 51% of the total greenhouse gas emissions (Goodland and Anhang 2009, 2). The figure includes impacts of cutting rainforest for grazing, respiration and waste that animals produce.

Livestock sector is the largest anthropogenic user of land. Raising animals for food occupies up to 45% of Earth's land (Thornton, Herrero and Ericksen 2011, 1), while feed crop production consumes one third of all arable land (FAO 2006); consumes one third of the planet's fresh water (Clark, 2013); increased Amazon deforested areas used for agriculture and cattle ranching from less than 3 % (of the total area) until 1970, to over 10% nowadays (Margulis 2004, 9); is a leading cause of species extinction, habitat destruction (Hogan, 2014) and ocean "dead zones" (Paine, 2012).

World agriculture consumes approximately 70% of the fresh water withdrawn yearly (Pimentel, 2004). This is because the production of meat and dairy products is water intensive. For example, 1 kg of broiler chicken requires 3500 liters of water, 1 kg of beef needs 13,000-43,000 liters, pork needs 4,000-6,000 liters, 1 liter of milk takes 700 liters of water, and one egg – 135 liters (Vegetarian resource group 2015).

The UN reported that three-quarters of the world's fish resort are overexploited, fully exploited or significantly depleted due to overfishing (FAO 2015a). Overall capture of inland and marine fish is about 90 million tons per year (FAO 2012, 6). Not only fish species are lost, but the habitats are destroyed. Also, fishing causes killing of other species, because big nets and lots of hooks are used for catching. 40% of fish caught globally is discarded every year. It is estimated that as many as 650,000 whales, dolphins, seals (Goldenberg, 2014) and 50 million sharks were caught as by-catch and killed annually by commercial fisheries (Shark savers 2012).

Over 9 billion land animals are killed each year in the USA to produce food. Globally, this number exceeds 70 billion. Another issue is that hundreds of thousands of wild animals are exterminated yearly in the US to keep them from interfering with agricultural operations and livestock. Tens of millions of birds are poisoned yearly to keep them from eating animal feed (A well fed world 2015).

The human population of 7,3 billion drinks about 20 billion liters of water and eats 9 billion kilograms of food per day (based on approximate 2,8 liters of water and 1,3 kg of food per person per day). While cows population of 1,5 billion (FAO 2015b) drinks about 70 billion liters of water (about 45 liters per cow) and eats 25 billion kilograms of feed per day (approximate 17,5 kg per cow, excluding hay and straw) (Домашнее животноводство, 2009). 50% of grains grown worldwide are fed to livestock, while about 800 million people suffer from malnutrition mostly in developing countries (Sansoucy, 2015). According to Richard Oppenlander (2014), 82 % of starving children around the world live in countries, where food is fed to animals, which are killed and eaten by wealthier people in the developed countries.

Amount of land needed to feed a pure-vegetarian for a year is equal to $690m^2$. Meat-eater needs $13{,}150m^2$ (almost 20 times more) (Laurie, Friedrich and Green 2006, 9).

Currently the use of renewable energy sources is promoted worldwide. However, wide development of renewable energy infrastructure is projected to take at least 20 years and 18 trillion dollars. Another solution to climate change is to stop eating animals. This action can be done today without investments (Oppenlander, 2014).

According to Will Tuttle (2014), if all the society did go vegan and people did not kill animals for food, then there would be no need to breed and feed them, no need to devote vast areas to grow grains and legumes. As a result, the forests, wildlife, air and oceans would come back, the rivers would run clean, and people's health would return.

Human health

This chapter is based on the works done by the American doctors and researchers, such as Colin Campbell, Caldwell Esselstyn and Doug Lisle, which are described in the documentary called "Forks over Knives", being written and directed by Lee Fulkerson (Forks over Knives 2011).

The growing number of researches state that if people exclude or significantly reduce the amount of eaten refined and processed food and food of animal origin, several types of degenerative diseases can be eliminated or cured.

For example, the research called "The effect of dietary protein on carcinogenesis of aflatoxin" (Madhavan and Gopalan, 1968) showed direct interconnection between the amounts of protein of animal origin in food and the development of cancer. Rats were fed with 2 portions of food. The first one had 20% of protein (casein) and the second one had 5% of protein from the overall amount of calories. Results showed that 20% protein-portion turned on cancer development, while 5% turned off or did not start the development of cancer. Further studies by Colin Campbell proved that the diet with 20% of plant-based protein from soybeans or cereal crops did not provoke cancer. The level of protein consumption by Americans is also within the range of 5-20% (Campbell, 2011).

Caldwell Esselstyn worked with 18 patients during 5 years who had chronic diseases of heart, and cured them with healthy diet. For 11 people disease was stopped, while 4 had

its regression (improvement). Diet gave results, which medicine and surgery never gave before (Esselstyn, 2011).

The United States, founding country of the modern western nutrition system, has high obesity rates among its citizens – 34,9 % adults are obese as of 2014. These people are prone to having heart disease, stroke, type 2 diabetes and certain types of cancer. The estimated annual medical costs of obesity were 147 billion dollars in 2008 (CDC 2014).

According to Doug Lisle (2011), the consumption of unnatural and highly saturated food is the main reason of obesity. The process begins with receptors in the stomach, which define how much food was consumed and its caloric density. For example, 500 kcal of natural plant food fill the whole stomach, turning on the receptors, which give signals to the brain that the organism is fed. However, 500 kcal of unnatural industrial food (poor in minerals, water and fiber) fill stomach to a smaller scale, tricking the receptors, which give signals to brain that more food is needed. The worst case is 500 kcal of oil, which almost does not turn on the receptors.

Vegetarian diet means consumption of products, which originally come from whole, minimally processes plants, such as fruits, vegetables, cereals crops and legumes. It means rejection of food of animal origin, such as meat, milk products and eggs, as well as industrially processed products – bleached flour, refined sugar and oil.

Analysis

SWOT analysis is presented in Table 21.

TABLE 21. SWOT analysis for "vegetarianism"

	Helpful to meeting the objective	Harmful to meeting the objective
Internal factors	**Strengths** - Sustainable approach towards the environment: small amount of produced greenhouse gas emissions, efficient land and water use, no habitat destruction and extinction of species - Gives opportunity to restore degraded environment and lost wildlife - Provides resources to feed people, who are currently hungry - Healthy approach for human diet: prevents and cures some degenerative illnesses, prolongs the life - Sincerely accepted vegetarian diet makes person feel happy, healthy and full of energy - Makes person feel great taste of herbs, vegetables, fruits and cereal crops - Returns back values such as compassion, integrity and kindness to people	**Weaknesses** - Challenging to develop systematic and correct diet at the beginning - Habits of eating meat and industrially processed food can be difficult to change - Doctor's consultation might be needed to become a vegetarian
External factors	**Opportunities** - More and more businesses and studies related to vegetarianism are done and popularized - Increasing consciousness among the society about health and environmental advantages of being a vegetarian	**Threats** - Cooperation between the governments and animal-based food industries in supporting animal agriculture, and suppression of those who are strongly against their interests - Own disbelief that it is possible to have a fulfilling life being a vegetarian

Adoption of vegetarian diet is mainly based on individual initiative. Governments and majority of food industries promote animal-based and industrially processed food, despite its harmful impacts on the environment and human health. Examples of people who are vegetarians, educative documentaries, blogs and books are good ways of getting to know about the usefulness of vegetarianism. Consultations with doctor can also be useful. Particularly with that doctor, whom Thomas Edison defined as the doctor of the future – the one who will no longer treat the human frame with drugs, but rather will cure one and prevent disease with nutrition.

4 DISCUSSION

4.1 General patterns in the results

SWOT analysis for the implementation of 20 best practices is presented in Table 22.

TABLE 22. Common SWOT analysis for 20 best practices

	Helpful to meeting the objective	Harmful to meeting the objective
Internal factors	**Strengths** - Balance country's social, environmental and economical sectors - Circulate the resources rationally in biological and technological systems - Eliminate overexploitation and pollution of the environment - Protect and restore nature and wildlife - Sustain and benefit human health - Enhance economic development - Provide jobs and distribute wealth - Educate people	**Weaknesses** - Implementation depends on many factors – economy, politics, education - Some practices are costly and may not work everywhere - Expertise, control and maintenance is needed to start and sustain the systems - Challenging to bring up the behavior and values in the society
External factors	**Opportunities** - Growing environmental concern and awareness among the society - Sustainable development as a focus of international agenda - Development of technologies - Development of countries - Globalization and learning from each other	**Threats** - Pursuit of only financial profits - Economy and lifestyle oriented on high consumption of resources - Suppression of real solutions - Indifference of people - Own thinking that it is impossible to do something

Waste management in Europe

Based on Table 3, it can be seen that few European countries have high recycling rates, and landfilling is widely practiced in the region.

Statistics (table 23) shows that the higher is the Gross Domestic Product (GDP) per capita, the higher is the waste generation per capita and the less is the landfilling in the country. Data indicates that the recycling rates are not strongly interconnected with the

GDP. For example, Slovenia recycles 20-28% more comparing to Finland or Italy, while it has approximately twice lower GDP per capita.

TABLE 23. Comparison of GDP/capita (2013) and waste management data (2012) of 5 EU states (adapted from World Bank 2015 and Eurostat 2014)

	GDP/capita in $	MSW treated, kg/person	Recycled & Composted	Landfilled	Incinerated
Germany	46,250	611	65	0	35
Finland	49,150	506	34	33	34
Italy	35,600	529	38	41	20
Slovenia	23,300	362	47	51	2
Estonia	18,800	279	40	44	16

Germany, Finland and Italy use more of incineration instead of sending waste to landfills, while Estonia and Slovenia recycle waste more. Possible explanation can be that the construction of incinerators is expensive, and that is why countries with less developed economies prefer to recycle and dump waste to landfills.

Legislation is crucial

Legislation is crucial for the implementation of the majority of practices. Tax introductions are used to regulate the consumption of certain products and direct business activities towards circular economy (e.g. recycling of bottles, purchasing of low-emission vehicles, etc.). Construction norms define minimum requirements for energy efficiency of the buildings. Public Health Act defines littering as environmental crime. These legislative tools enable the formation of a sustainable country.

However, some practices, such as individual initiatives, are not dependent on the government. They can be realized individually when person understands their importance.

Importance of education

Sustainability needs educated society. All the practices, which are interconnected with the society, show this dependency. For example, greening of a city needs educative work with a community, because otherwise people will act according to their old habits and spoil the new green environment. Also, educative work with children is a starting point in transforming citizens' behavior and attitudes (Van Vliet, 2014).

Individual education and initiatives show higher results, comparing to when it is done under the law. For instance, Zero Waste community in Vrhnika, which independently initiated the program, recycled 76% of its waste in 2014 (Van Vliet, 2014), while in Germany it was 65% in 2012 (table 3). At the same time Lauren Singer who lives Zero Waste lifestyle practically does not generate waste (Singer, 2015).

This tendency shows that the more educated people are and the more sincerely the practice is accepted, the better is the performance.

Economy and wealth of citizens

For nation to develop and act sustainably country's economy has to work and financial wealth of citizens needs to be sufficient. Wealthy states have resources to realize projects that lead to sustainability. Also, stable and growing economy gives opportunities for people to become wealthy. When the person has financial resources, which help to satisfy basic human needs, he/she develops personally, becomes a responsible member of the society, takes care of others (people and nature) and starts to think of how to be useful in this world. This gradual development is described by the Maslow's Pyramid (figure 7).

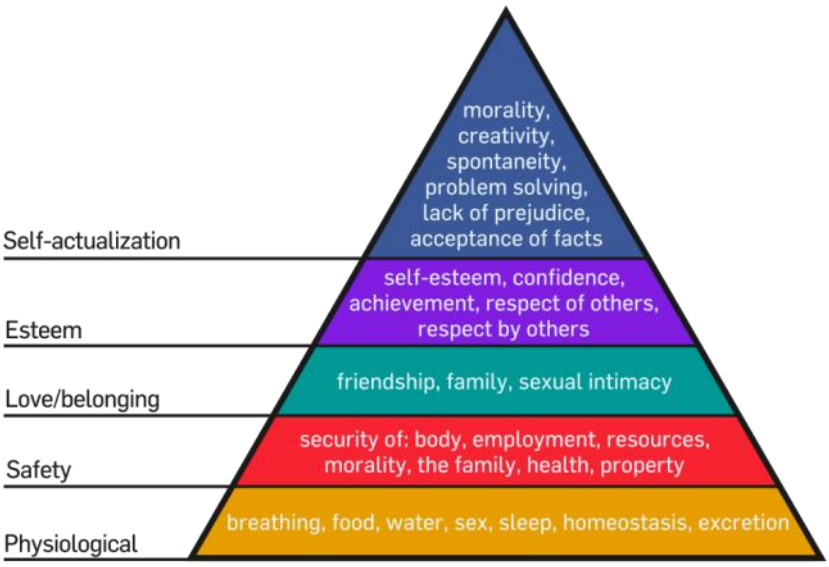


FIGURE 7. Hierarchy of human needs with basis needs at the bottom (User: Factoryjoe. CC BY-SA 3.0)

Education and how parents raise up children is important. However, if people do not have means to sustain themselves and their families, then their focus is mainly on the survival, which often results in irresponsible and unsustainable actions (e.g. cutting trees for heating, robbery, eat cheap unhealthy products, etc).

The needs

Singapore used to be depended on fresh water supply. This concrete need was the reason why the government decided to collect rainwater and assure that no effluences were drained to the channels with potentially drinking water. Same issue of water scarcity resulted in the industrial symbiosis at Kalundborg Eco-Industrial Park.

Communication plan is crucial for the adoption of practices. However, it can be seen that the main reason of the success of every practice is in concrete benefits that parties, which cooperated, got (e.g. government and people: depositing of bottles; companies and companies: Eco Industrial Park; or people and people: individual initiatives).

Appointing educated and passionate people to do the work, as well as asking for consultation from the experts, is one of the defining factors for the successful implementation of the practices.

Raising awareness about environmental protection among the society

Environmental performance is becoming a selection criterion for both consumer and industrial markets. This phenomenon results in implementation of environmental management standards such as ISO 14000 in enterprises, and in sustainable production of goods. The reason is that customers' demand for environmentally friendly products and services is growing, due to the growing environmental awareness of the society (Miles, Munilla and McClurg 1999, 111).

4.2 Projected implementation of the practices in Ukraine

This section has opinion-based character. It includes author's individual suggestions for the realization of 20 best practices in Ukraine.

4.2.1 Current issues

In Ukraine waste infrastructure circulates around landfilling practice and only 74% of the population is provided with waste management services. 93% of the waste is dumped to landfills, 4% is incinerated and the rest is composted. There is no legislative support and economical stimulations for the development of infrastructure and systems to manage waste sustainably. The reason is in the passive attitude of the government at its all levels (UA-ekonomist 2012).

For example, there is waste recycling factory in Rivne region, which was constructed in 2013. However, soon it stopped its operations and does not work until the present time, because the mechanism of waste recycling is missing in the legislation (ОГО 2015).

4.2.2 Solution

There is a Ukrainian movement called "5.10". It promotes adoption of a governmental system with only two taxes in the country – 5 % from the sales (for businesses) and 10% from the income (salary). The goal is to create a simple system with a transparent government that acts outside the economy. Theoretically it will eliminate the indifference of the government to country's development, assure fulfillment of the Law by everyone, promote entrepreneurship and attract global investors to earn in Ukraine. The results will be a formation of wealthy society, developed infrastructure and wide variety of services, as well as clean environment that will be protected (5.10 2015).

4.2.3 Realization of "waste management" practices

Priority is to make waste management a profitable business. When it happens, processes, such as waste sorting, collection, recycling, and work with community will begin.
Case studies show that sustainable waste management can be realized when there are recycling plants. If they are not constructed and there is no collection and supply system of waste, landfilling will continue to prosper and there will be no point in adopting the majority of practices. Also, case studies show that it is extremely difficult to get people involved in doing anything if they do not get any benefits from doing that.

Therefore, the first step for Ukraine is to adopt appropriate legislation that will facilitate creation of sustainable waste management, for example, the one based on the EU principles, but with own goals. The second is to open the market for entrepreneurs, both Ukrainian and international, in order to develop waste infrastructure. When companies see that there are opportunities to earn and that the government gives long-term support for investors, they will do the business (Hoogendoorn, 2015). The thirds step is to do the community work by educational and awareness raising campaigns and give valuable reasons for people to participate in the practices (e.g. deposits for recycling the bottles).

Eco-landfill

Ukraine sends waste to landfills, 20% of which do not correspond to ecological norms while private sector dumps waste to self-made landfills that are scattered around the country and are not controlled (UA-ekonomist 2012).

For Ukraine to make a transition towards sustainably waste management of its landfills, firstly, advanced legislative foundation should be created. It includes requirement to meet standards that no effluent can enter groundwater, but to be collected and treated, methane to be collected and used for energy production, open landfills to be prohibited, etc. Secondly, current landfills of old type to be converted into efficient ones. Thirdly, experts help should be used when establishing new landfill in order to do if effectively and avoid unwanted surprises.

Incineration

Waste management in Ukraine is at the beginning of establishment. It means that there are choices of how it can be done. According to the waste management hierarchy, focus has to be on prevention and recycling practices. However, the recycling system is not working in Ukraine (UA-ekonomist 2012) and its implementation is a long-term project, because it requires creation of factories, infrastructure, fleet of trucks and work with community. Incineration can be a workable solution during transitional stage.

Sorting and recycling

Comprehensiveness of German waste management system makes it effective. There are clear regulations, educational programs, convenient methods to manage the waste and infrastructure to collect and recycle it. Also, population of 82 million people

(Worldometers 2015) forms big waste market, and developed economy maintains the system and facilitated its establishment.

Ukraine with 44 million citizens (Worldometers 2015) also forms large waste market. In order to develop sustainable waste management system, legislation should facilitate it and make waste business profitable. The concrete task is to create legislative base that reflects EU waste management norms and regulations (UA-ekonomist 2012).

Zero Waste Strategy, deep collections containers and Green Dot system

Zero Waste system in a community needs a presence of recycling facilities and theirs supply chain. When such appear and people get benefits from sorting waste (e.g. "pay-as-you-throw" scheme), a pilot project in a small Ukrainian town can be done.

Use of deep containers for waste is beneficial in financial, social and environmental terms. However, implementation of this practice would mean that the present waste infrastructure would have to be replaced, because waste is collected to one bin and the truck fleet is adapted to particular types of containers. People would have to develop sorting culture and dispose waste to deep containers that are located on the streets (currently waste in apartment buildings is mainly disposed from each floor via tube that goes from the building's top to the bottom).

Green Dot system can be created when the law that will require food manufacturers to pay fees for the recycling of packaging of their products is adopted. This practice will immediately reduce the amount of generated waste and provide money for recycling.

Depositing of beverage containers

Recycling of beverage containers in Finland is a great example of how sustainability in this field can be met. As PALPA is owned by the Finnish breweries and retail industry, it is their financial interest to have an effective system. The more containers are collected and recycled, the more money is saved. The better it is to the environment and to the image of the companies.

Such system has high chances to work in Ukraine. People are more likely to recycle the bottles because of the deposit. However, it might be difficult for shopkeepers to buy and install reverse vending machines (RVMs), because they are manufactured abroad and

are expensive. Current buying power of the Finnish shopkeeper is higher than that of the Ukrainian, meaning that it will be a challenge for the shops in Ukraine to install RVMs. By developing the economy it will be easier to introduce the system.

Before that, minimum of what can be done is to create a demand on recycling beverage containers. It can be implemented by imposing tax that requires every producer to pay for the recycling of containers from the drinks.

Currently, there are some shops that allow depositing of certain glass bottles. It is done when a shop has contract with a manufacturer for returning empty containers. This practice is popular, particularly among people who collect bottles on the streets to earn money. However, to make it on a nationwide scale, it must be convenient for all people to deposit bottles for which they can get worthy financial reward.

Prior or during the creation of national network of RVMs, each city can create special "deposit-islands" to where people will bring beverage containers and get deposits back; and from where collected and separated bottles will be sent to the recycling factories.

Adoption of the deposit system for beverage containers gives opportunities to create businesses and employment, develop responsible nation, preserve resources and make environment cleaner.

Used equipment as a humanitarian aid

The practice works in Finland because its system of social welfare is developed, meaning that it is continuously financed. The case in Ukraine is different. Many public hospitals, schools, kindergartens and other institutions around the country, particularly in small towns and villages, lack proper furniture and equipment. As an example, the hospital in my hometown Netishyn was not practically renewed since 1991 as Ukraine became independent. In 2012 I and my father organized a social project in which we cooperated with Finnish Hyöty Työ and sent 15 tons of humanitarian aid for the hospital and community of disabled people in our town. People were happy to get well-functioning equipment, even though it was previously used in Finland.

The practice of donating humanitarian aid internationally can be done by the countries that have financial resources for that. This is not the case for Ukraine in the nearest dec-

ade. However, old equipment that is replaced with new, for example in rich schools in cities can be donated to poorer schools in villages. For this to occur, cooperation and communication should be done between the institutions. There needs to be an online database that will collect information about what equipment is available and where it is located, so that it can be easily picked up.

Plastic bag levy

Irish example shows that consumer's behavior and amount of generated waste can be influenced by the price increase on a bag. There is a clear tendency – a higher price results in a lower consumption.

Consumers in Ukrainian shops are already charged for big plastic bags. The price is about 2 UAH, while one loaf of bread (1 kg) costs minimum 7 UAH. Comparing to Finland, bag costs 0,2 euro, while one loaf of bread costs about 2 euro. Therefore, Ukrainian bag costs almost one-third of bread (28,5%), while Finnish bag costs one-tenth of bread (10%). It might be too tough to increase the price on plastic bags in Ukraine, because it is not right when basic plastic bag costs same money as a loaf of bread. However, price increase can be done in Finland.

To reduce the usage of plastic bags in Ukraine, more appropriate method would be to lead educational and promotional programs. For example:

- Plastic or paper bag can have positive design and be printed with statements such as "I am still good, use me few more times", which will make people think before they plan to throw it away or leave without use.
- Children can be taught at schools to act environmentally friendly. One of the lessons is to use one bag regularly rather than to buy new often; for example that can be a beautiful cotton bag used for shopping purposes.
- Idea of own cotton bags can be a national movement, so that each person will express him/herself via own design. New businesses can arise, which will create bags for customers according to their individual wishes. This way person will appreciate his/her bag and go with it through the city to the shop, making others to see it and get the positive message.
- Media can popularize the idea for people to act sustainably and to save money by using one bag.

As a foundation to all these actions, people should feel and see that the country is aiming to be environmentally friendly. This is a task of the national government and local city councils. If message is not given from the above and people do not see that the leaders of the nation act sustainably, then individual initiatives will have low effectiveness. When there is no focus on a certain action and when people see bad examples around themselves they tend to act in the same way. It is well seen in a family case – if parents litter in a forest, then most probably their children will do the same.

4.2.4 Realization of "transportation" practices

Carbon dioxide-based car tax

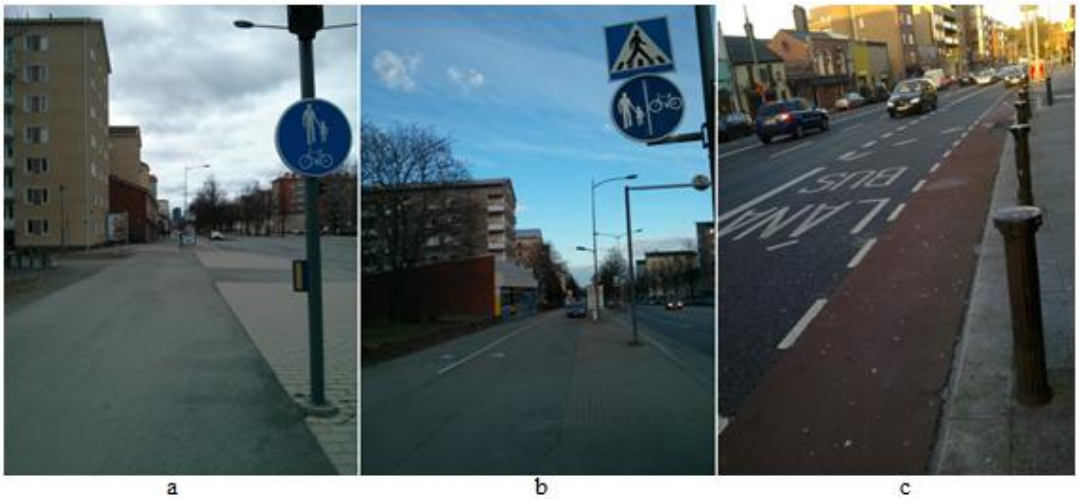
Even though, imposing of CO_2-based car taxes is not a concept of circular economy, this practice can be considered as transitional that leads to circular economy, where renewable energy is used to power vehicles. Tax on CO_2 is one step further in developing environmentally responsible society, and it is one of the best available techniques of the present time of how carbon dioxide emissions from using cars can be minimized.

However, practice has slow progress in Finland. According to the Transport Safety Agency, statistics in February 2012 showed that newly registered cars with average level of carbon dioxide emissions have fallen by 2,6 % comparing to the same period of year 2011. Average CO_2 emissions level in 2011 was 146 g/km, while in 2012 it reduced to 142 g/km (Trafi 2012). Also, reduction can be caused by yearly variations.

The reason can be that the tax difference between having low and high emission vehicle is small. For example, the base tax difference is about 150€ per year (Trafi 2015). My analysis shows that in order for the system to work better, the tax on high emission vehicles should be increased and the tax on low emission vehicles should be decreased.

Cycling in a city

European countries where I lived and cycled on a daily-basis are Finland and Ireland. Their cycling infrastructure it is established differently (picture 8).



PICTURE 8. Cycling lanes in Tampere – a and b, and in Dublin – c

In Finland cycling lanes are next to pedestrian lanes, or bike can be ridden along pedestrian lane. In Ireland, Dublin particularly, cyclers are separated from pedestrians, and have to ride mainly along allocated paths next to the roads.

Finnish way is more comfortable and safe, because paths are usually wide and there is no opportunity to contact vehicles. Cycling in Dublin is stressful, because cars and buses drive closely to bicyclists. Also, when car is parked next to the road, passengers can rapidly open doors without looking to the back. This causes incidents where cycler hits the door, resulting in personal and bike damages, damages of car and its passenger, and causes traffic jam.

According to my analysis, Dutch cycling system is one of the best in Europe, because:

- Government provides safe, fast and reliable way of transportation. Development and sustaining of infrastructure is continuous.
- There are various types of paths, each being specifically used to perfectly suit certain conditions.
- There is a comprehensive parking infrastructure.
- Cyclists and car drivers respect each other.
- Cycling is a part of culture and normal daily life activity.

Currently in Ukraine some people ride bike along the pedestrian lanes in towns, while in cities, where streets are busy and full of people, cyclists ride along the roads. However, there are no allocated lanes and the usage of bike on a daily basis is not popular.

To make cycling an integral part of the Ukrainian culture, work should start from providing allocated bicycle paths and parking. People should have safe and convenient way to ride a bike. In areas that have been already constructed, vacant places can be utilized to create parking slots; roads or pedestrian lanes, which were not initially designed to include cycling lanes, can still have them if being separated (picture 8b), particularly in wide places. Car drivers should be promoted to respect cyclers; drivers' aggressive behavior and over speeding should be controlled and changed by the police by imposing fines. In new areas, which are under construction, cycling lanes and parking slots should be included into the design.

Promotion of cycling is another key-factor in establishing effective system. Once infrastructure is in place, some people will begin to use it immediately, which will be the first promotional method. Campaigns to popularize the benefits of cycling can be done via media. City's major and other officials can use bicycles when going to work, so that people see it and possibly do the same. Based on the Maslow's Pyramid (figure 7), bicycle robbery can be eliminated by developing wealthy society, so that people satisfy their basic needs themselves and do not have reasons to steal someone's property.

Before starting national program of creating cycling infrastructure, test projects in some towns can be done. Government, engineers, community and other related parties will find issues that need special attention during projects' realization. By doing this, future mistakes on a big scale can be eliminated.

4.2.5 Realization of "landscape planning" practices

Singapore's examples show that environmental practices can result in overall sustainability and be beneficial to both economy and society.

Greening of a city

Creation of city or town-gardens has many benefits, which immediately start to pay back relatively small investments. To do these projects in Ukraine, city councils need to become enthusiastic about the idea and provide the funding. To do it cheaply, trees from the areas, which soon will be under the construction or from the forests that will be cut down, can be replanted to the city. Also, "Tree Planting Day" can be arranged every

year, so that the community is involved. A group of experts can be assigned to develop city's new green appearance.

Another task is to overcome many people's indifference regarding the natural environment in Ukraine. For example, many children climb the trees and break them purposely, people walk and park cars on the lawns. This can be changed when parents and government will feel their responsibility for their children and community. After this, various methods can be used, such as to issue fines, teach and bring up kids at home and at schools responsibly, do public campaigns, etc.

Water and wastewater management

The quality of water and its treatment are low in Ukraine. The reasons are that the surface and ground waters are continuously polluted by the effluents from the industries, and that treatment plants and water supply date back to 1950s. Only chemical and microbiological properties are used for the analysis of water, which is not enough to determine its quality (Kuryk, Semchug and Skubchenko, 2012). The water is chlorinated and can contain toxic substances, such as ions of hard metals, phosphorus and sulfur compounds, pesticides, nitrates and nitrites (Компоненти довкілля 2014.) It means that drinking tap water without individual filtration is dangerous for health.

Immediate solution for people is to use commercial filters. However, long-term solution is to eliminate the reasons of low water quality, which are the effluents from factories and enterprises as well as aging technology of water treatment. Pollution of water bodies has to be forbidden, strictly controlled and punished. Investments are needed into renovation and development of water supply and treatment systems.

Eco-Industrial Park

Implementation of EIP is new for Ukraine. There is a lack of environmental consciousness among the enterprises. Moreover, if the government does not require businesses to meet certain standards, then the heavy players on the market, such as power plants, metallurgy factories and other enterprises that generate big quantities of by-products and energy, will ignore opportunities of symbiosis. The reason is that investments are needed to create the bonds and launch the system of cooperation, and because government does not punish for the pollution of the environment, there will be no financial interest for enterprises to act sustainably.

Shift in consciousness of the owners of the enterprises is needed. It can come quickly, if the government sets regulations and fines those who do not comply, or it can take long time until the society, including the businessmen, realizes that the change is inevitable (e.g. when polluted environment poses threat to people's lives).

Efficient houses

The promotion of the practice for individual use can be done by creating "resource advice services", where people will be able to get free and professional information about how to maximize efficiency of their households. It has to be impartial and do not promote certain company, because this way people will see that the real interest of the service is to provide proper information and not to sell particular products (Gireesh 2012, 7). Therefore, people's trust and interest will grow.

Based on the studies done in Ireland it can be concluded that the crucial factor in developing efficient buildings nationwide is to adopt the Construction Law that will set standards (Kondratenko, 2006). It will make the companies to meet the regulations for the new projects and the owners of existing buildings will have to upgrade them.

Sustainable agriculture

Many people in Ukraine have own farms in the countryside, where they grow own plant and animal-based products. In individual cases it is done without use of chemical additives, because people want to eat healthy food. However, work is often based on old techniques with low efficiency and productivity, and the soils are not managed properly. In terms of the national agriculture the main issues are the old technological base (average age of machinery is 30-35 years), aging of professionals, reduced interest of young people to work in agriculture, the depletion of the majority of soils because of unsustainable growing and lack of rehabilitation practices, and low state's financial support and foreign investments into agriculture (Oleinykova and Emtseva, 2010).

Agricultural magazines and TV programs, forums and professional consultancies can be source of information about sustainable and effective growing methods for the citizens.

In terms of agro-businesses, development of the country's economy, gradual upgrading of agricultural infrastructure, setting of norms regarding growing methods and creation

of the national consultative center can contribute to the development of sustainable agriculture on a wide-scale. Also, cooperation with foreign experienced firms can be useful, because new growing methods and ideas for improvements can be found.

Development of the market for sustainable agricultural products needs educated society who is able to pay for them. People have to understand that industrial agriculture, which produces big quantities of food at low prices, is unsustainable.

4.2.6 Realization of "environmental legislation" practices

Legislation and punishment for environmental crimes

Majority of the case studies show that legislation is a base to approach sustainable development in all sectors of the country. It is so, because the laws give guidelines for enterprises and individuals to act appropriately and also because legislation has a nationwide effect, meaning that fulfillment of the laws is a requirement for all citizens everywhere in the state. EU Directives (e.g. Waste Framework Directive) can be the base to develop Ukrainian legislation.

Financial penalties for violation of environmental and hygienic norms are high in Singapore. The fact that the country developed civilized nation in several decades means that practices, which are adopted, there are effective.

I have personally experienced the hardness of paying big fines for violating traffic rules in Finland, particularly for inappropriate parking. Getting a ticket worth 60 € after seven hours of work, during which those 60 € were earned, is a very difficult emotional experience, which you do not want to feel ever again. As a result, I became a well-behaving driver and park my car appropriately now. According to my experience, issuing high fines is effective way to educate people, because it needs shortest time and involves minimum resources.

4.2.7 Taking “individual initiatives”

Zero Waste lifestyle and vegetarianism

By taking only what is needed for life and doing it wisely, person can produce no waste, be friendly the environment and sustain own health. Individual has to be strong to accept Zero Waste lifestyle and vegetarian diet, because tension can be experienced due to the unusual behavior at the beginning. To popularize the concepts among the society, effective method would be to study the materials and learn from the experiences of others.

If all people would become Zero Waste and vegetarians, many businesses would stop or reduce incomes. Due to the facts that governments and companies are often interconnected and that consumption of goods is promoted by continuous marketing, such practices are out of the interest at the national levels. Therefore, it is a responsibility of each individual to get educated and act environmentally responsible.

4.2.8 Reasons why practices can work in Ukraine

Factors that facilitate the implementation of 20 best practices in Ukraine are following:

1. The population is 44 million people. It forms large waste market and makes recycling of various by-products profitable.
2. Ukrainian culture is similar to European. It can facilitate the implementation of practices that originate from the EU.
3. The EU continuously helps to the government of Ukraine by providing loans and expertise to reform the country to European standards.
4. GDP per capita is low - about 3900 $ (World Bank 2015). It can be assumed that there is a demand on practices that will allow people to save money (recycling of bottles, cycling, etc.). However, low GDP is more a reason why the majority of practices cannot work currently in Ukraine.

5 CONCLUSION

Sustainable development goes beyond geographical or institutional boarders. Its implementation needs consideration of economical, environmental and social aspects that are involved in the decision-making and actions of the government and every individual.

Sustainable development is a challenging continuous process. For this reason, it can be considered as a lifestyle with no ending point. Theoretically, progress of a country will result into replacement of transitional practices. The ones that will be applied will mimic the cycle of man-made products in industrial ecosystems and direct people to act sustainably, similarly as these processes run in nature.

Case studies show that the implementation of the practices which reflect the ideals or lead towards circular economy can be achieved by the counties with facilitative political and economical conditions.

Educational perspective and presence of benefits defines how society will act regarding each practice. The analysis indicates that the more educated people are and the more benefits they get by participating in the practices, the better are the outcomes.

Implementation of the 20 best practices is possible in Ukraine. The country's population forms big market and good relations with the European Union can facilitate the adoption of the practices. However, low GDP makes it almost impossible to realize costly projects. The original need for the government is to provide favorable conditions to do business in Ukraine. After that, the 20 best theoretical practices can become reality.

The selection method of the best practices is subjective because it is based on personal observations and this can be a place for improvement. Other practices of the similar nature which are more effective might be found. The selection process can be improved by choosing the ones that do not require big financial investments. It is important for Ukraine and other developing countries because they do not have financial resources to implement expensive practices at the moment. The focus can be on finding transitional practices which can be replaced by the ones that represent the ideals of the circular economy when the country's legislation and economy allow that.

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